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No. 13

LAUNCH OF PACIFIC MAIL LINER KOREA.

THE BIGGEST STEAMSHIP EVER CONSTRUCTED ON THE AMERICAN CONTINENT
—WITNESSED BY A LARGE AND DISTINGUISHED GATHERING.

The launching of the Pacific Mail liner Korea at the yards of the Newport News company, Newport News, Va., last Saturday, was attended by thousands of people. The event was worthy of the attendance, for the vessel is the largest which has ever been launched on the American continent. The vessel was christened by Miss Catherine Winthrop Tweed of New York and the ceremony took place without a hitch. The sister ship Siberia will follow the Korea into the water in about a month. The great size of these sister ships can best be appreciated by comparing them with the St. Louis and St. Paul of the American line, which are somewhat shorter. These vessels will cost about \$2,000,000 each when completed.

The Review, in its annual ship building edition, published on Feb. 7 last, printed a complete description of these vessels, so that it will only be necessary now to recount their leading features. As both vessels are identical whatever may be said about the one applies equally to the other. The Korea is intended for the transpacific trade with terminals at San Francisco and Hong Kong. She is required by the contract to make 18 knots in regular service. Her dimensions are as follows: Length between perpendiculars, 550 ft.; length over all, 572 ft. 4 in.; beam, 63 ft.; depth, 40 ft.; draught, 27 ft.; displacement, about 18,000 tons. Accommodations will be provided for 200 first-class passengers, thirty white steerage passengers and 1,200 Chinese. Quarters for the latter are so arranged that the space may be utilized for other purposes if unoccupied by Chinese. The hull is constructed of steel with frames spaced 32 in. apart throughout. A double bottom extends from stem to stern and is carried up to the turn in the bilge. There are four decks extending the whole length of the vessels, and known as the lower, main, upper and promenade decks. In addition to these are the orlop and boat decks.

The main engines of the Korea consist of two four-cylinder, quadruple expansion engines of the vertical, inverted, direct acting type, placed abreast of each other in separate water tight compartments. The cylinders are of the following dimensions: High pressure, 35 in.; first intermediate pressure, 50 in.; second intermediate pressure, 70 in.; and low pressure, 100 in. diameter, with a common stroke of 66 in. The engines are designed to develop 18,000 I.H.P. while running at 86 revolutions per minute. The cylinders are arranged in the following order: High pressure forward, low pressure, second intermediate pressure and first intermediate pressure aft. The engine framing consists of cast steel columns of T section, secured to the cylinders and bed plate. The bed plates are also of cast steel. The valves are of the single ported, piston type, and are of cast iron. The link motion is the Stephens link type. All the cylinders are steam jacketed. The piston rods are of forged steel fitted with cast iron cross-head slippers lined with Parsons' white bronze, which work in cast iron cross-head guides. The connecting rods are of forged steel, 138 in. long between center of crank and center of cross-head pin. The pistons are of cast steel and are of the dished pattern. The eccentrics are of cast iron, keyed to the crank shafts. The eccentric rods and valve stems are of forged steel, the former being secured to the eccentrics by composition straps. Each main engine is fitted with a steam and hydraulic direct acting reversing engine and a 7 in. by 5 in. turning engine. The thrust bearings are two in number of the ordinary horseshoe type, with fourteen shoes to each bearing. The stern tube bearings are of the ordinary brass sleeve pattern, fitted with lignum vitae. The crank shafts are forged steel in four interchangeable sections. The thrust line and propeller shafts are also forged steel. All shafts are hollow. From the stern tube stuffing box to the propeller hub the propeller shafts have sleeves of composition for protection against the corrosive action of the sea water. The propellers are of the three-blade type, the hubs being cast steel and the blades bronze. There are two main condensers, one for each main engine. The air pumps of the main condenser are of the cross-compound Featherweight system, manufactured by the George F. Blake Mfg. Co., New York. In addition the vessel will have a complete outfit of Blake vertical pumps of the regular navy type. Two feed water heaters will also be installed.

The boilers, nine in number, include eight main boilers and one donkey boiler of the horizontal, return, fire tube type. The arrangement of boilers is as follows: One donkey boiler on the upper deck in the boiler hatch; main boilers placed in a fore-and-aft direction in two compartments; with all fire rooms athwartship; in the after boiler compartment two single-ended and three double-ended boilers, and in the forward boiler compartment three double-ended boilers. All these boilers are of Scotch type, and the steam pressure is 200 lbs. in the donkey boiler as well as in the main boilers. The diameter of single-ended and double-ended boilers is also the same, 16 ft. The two single-ended boilers will have four furnaces, with 76.58 sq. ft. of grate surface and 3,208 ft. of heating surface. The six double-ended boilers will have eight furnaces, with 153.16 ft. of grate surface and 6,416 sq. ft. of heating surface.

Probably no launch in the history of the country has drawn together so distinguished and varied a body of men. Every department of the United States government was represented, as were also the state officials of Virginia. Business men, railway presidents and financiers from New York, Philadelphia and surrounding cities were also present.

James Playfair, who has large interests in lumber, vessels, wrecking appliances, etc., in and around Midland, Ont., is having built at Dundee, Scotland, a steel steamer of Canadian canal dimensions. The Midland Navigation Co., now forming, will own the vessel. Her name will be Midland Queen. The equipment will be modern in all respects. The American Ship Windlass Co. is to furnish for the vessel a steam capstan and windlass and a steam capstan to go aft. The windlass is to handle 1 11/16-in. chain.

STRUGGLE TO REPRESENT THE STEEL CORPORATION.

From all parts of the lakes vessel men are looking to Cleveland for information as to who will look after the movement of 10,000,000 tons of iron ore for the United States Steel Corporation. Who will have the management of 112 steel ships owned by the big organization? Will its policy be one of concentration of producing, transportation and manufacturing interests, or will its constituent companies be allowed to continue undisturbed in management for some time to come? There is as yet no information worthy of publication on this score and probably will not be until names of the chairman of the board and general manager of the Steel corporation are given out. All sorts of rumors in dispatches from Washington and New York have been connected with the movements of Senator Hanna and his meetings with Mr. Morgan. Mr. Hanna has no ships or mines to sell to the consolidation, as the vessels and the principal mining properties controlled by M. A. Hanna & Co. were sold to the National Steel Co. some time ago and went into the steel corporation with the National company. But M. A. Hanna & Co. have an organization for the management of mines, ships and docks, and the senator's meetings with Mr. Morgan have undoubtedly been with a view to securing for this organization a part or all of the management of steel corporation affairs on the lakes. There are other organizations similar to M. A. Hanna & Co. and equally important, that are, of course, working along the same lines. These include Pickands, Mather & Co., the Carnegie Co., and the Rockefeller interests represented by Oglebay, Norton & Co. and the Bessemer Steamship Co. The success or failure of these different concerns in their efforts to represent the big organization will depend upon their influence with the chief powers in the Steel corporation. It is expected, for instance, that if Mr. Carnegie's chief lieutenants are continued in power they would naturally favor the lake management with which they have been associated, and so with the other different interests, but anything that might be said on this score as yet would be only a guess. The struggle is a spirited one and of great interest to a large number of men who hold important places not in Cleveland alone but at nearly all of the Lake Erie ports and in the mining region of Lake Superior.

Several important matters pertaining to the opening of navigation are, of course, delayed in part on account of this uncertainty. Nothing has been done towards fixing prices of Bessemer ores, but it is again said that the association will dispose of this question within a week. It is thought that the base price of Bessemer will be about \$4.50 or a little less. Within the week the managers of Cleveland ore docks on Lake Erie have concluded a complete agreement with the International Longshoremen's Association. The rate for shoveling ore has been fixed at 13 cents, as against 14 cents last year, and a slight reduction is accordingly made in all other classes of dock labor. Immediately following this agreement the dock managers fixed the rate to vessels for unloading ore at 20 cents, as against 22 cents last year. Producers of soft coal sold in the lake region—Pennsylvania, Ohio and West Virginia districts—will meet this week to fix prices, which will probably be a little lower than they were a year ago, and this will mean also some reduction in the price of steamboat fuel. The ship owners are doing practically nothing as regards the strike of engineers, as there has been no season for several years past when there was less reason for hurrying the movement of vessels.

PRODUCTION OF PIG IRON IN CANADA IN 1900.

The production of pig iron in the Dominion of Canada, as ascertained from the manufacturers by the American Iron and Steel Association, amounted in the calendar year 1900 to 86,090 gross tons, as compared with 94,077 tons in 1899, 68,755 tons in 1898, 53,796 tons in 1897, 60,030 tons in 1896, 37,829 tons in 1895, and 44,791 tons in 1894. The statistics of the association do not go back prior to 1894. Of the production last year 70,349 tons were made with coke and 15,741 tons with charcoal. The production of Bessemer pig iron, included above, amounted to 3,781 tons. Neither spiegel nor ferromanganese was made.

On Dec. 31, 1900, the unsold stocks of pig iron in Canada amounted to 12,465 gross tons, as compared with 9,932 tons at the close of 1899 and 9,979 tons at the close of 1898. Of the unsold iron on hand on Dec. 31, 1900, 6,900 tons were coke pig iron and 5,565 tons were charcoal pig iron.

On Dec. 31, 1900, there were ten completed furnaces in Canada and four furnaces were in course of construction. During 1900 one new furnace was completed at Midland, Ont., by the Canada Iron Furnace Co., Ltd. It was blown in early in December, 1900, and was in blast in January last. The other four furnaces referred to were all being erected by the Dominion Iron & Steel Co. at Sydney, Cape Breton, Nova Scotia. One of the furnaces was completed early in 1900 and was blown in on Feb. 5. Another will soon be put in blast.

NEW VESSELS FOR THE CLYDE STEAMSHIP CO.

The Clyde Steamship Co. is about to add to its already large fleet of freight and passenger steamships two of the most efficient and desirable vessels ever built for the coastwise trade. These steamships are being constructed by the Cramps, Philadelphia, and the first of them, to be called the Apache, will be launched on Saturday next. She will be 310 ft. long, 46 ft. wide and 31 ft. deep, with a speed of 15 knots and capacity of over 3,000 tons of cargo. Her accommodations for over 200 passengers will be entirely above the upper deck. She will be lighted throughout with electricity and all her fittings and equipment will be up to the highest standard. The second ship, to be called the Arapahoe, will be a duplicate of the Apache in all respects, and will be launched a month later. Both vessels will be placed in service between New York and Charleston, S. C., and Jacksonville, Fla.

CLYDE RIVER PASSENGER STEAMER.

A SPECIAL TYPE OF VESSEL WHICH HAS BEEN DEVELOPED TO MEET LOCAL CONDITIONS—VERY SPEEDY CRAFT.

[Special correspondence to the Marine Review.]

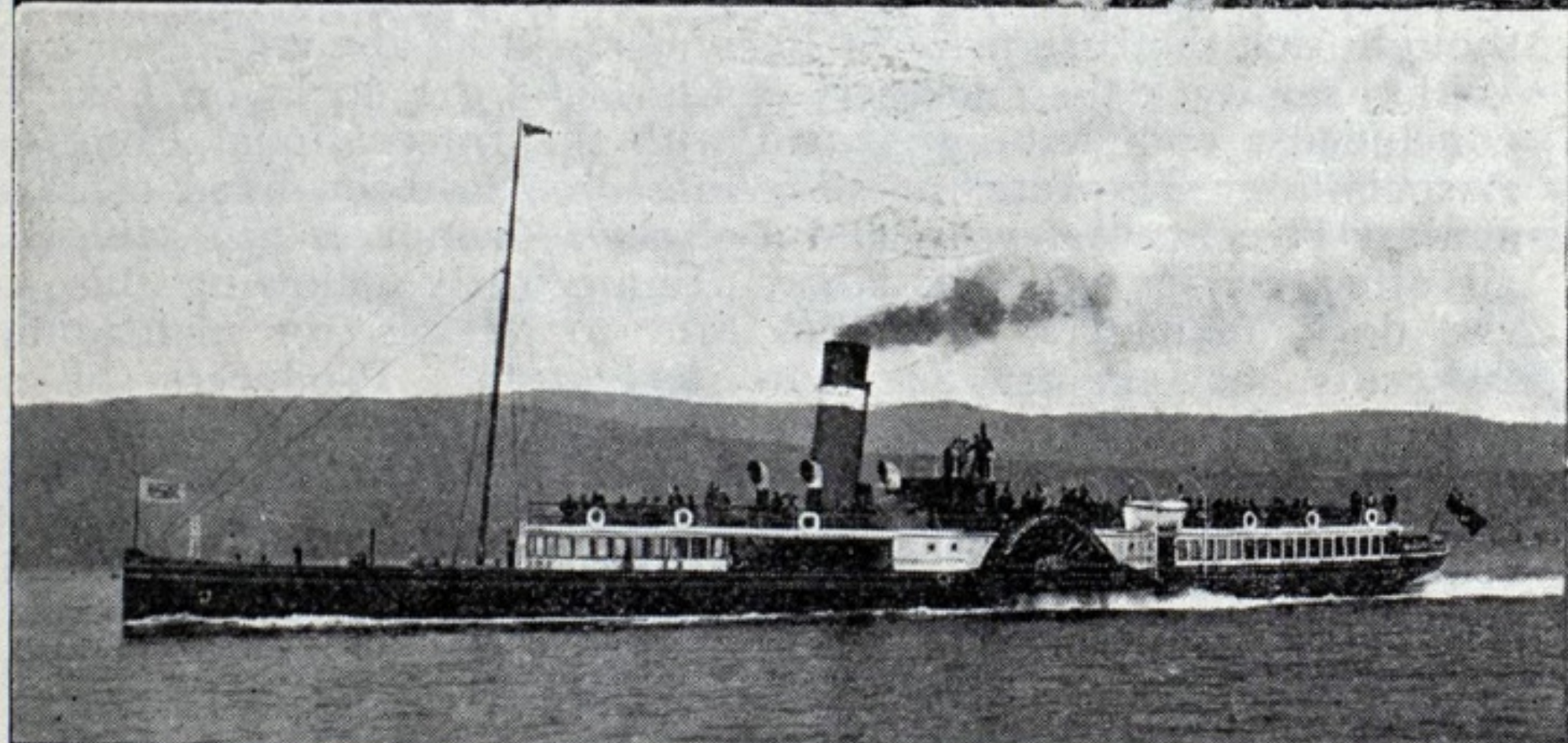
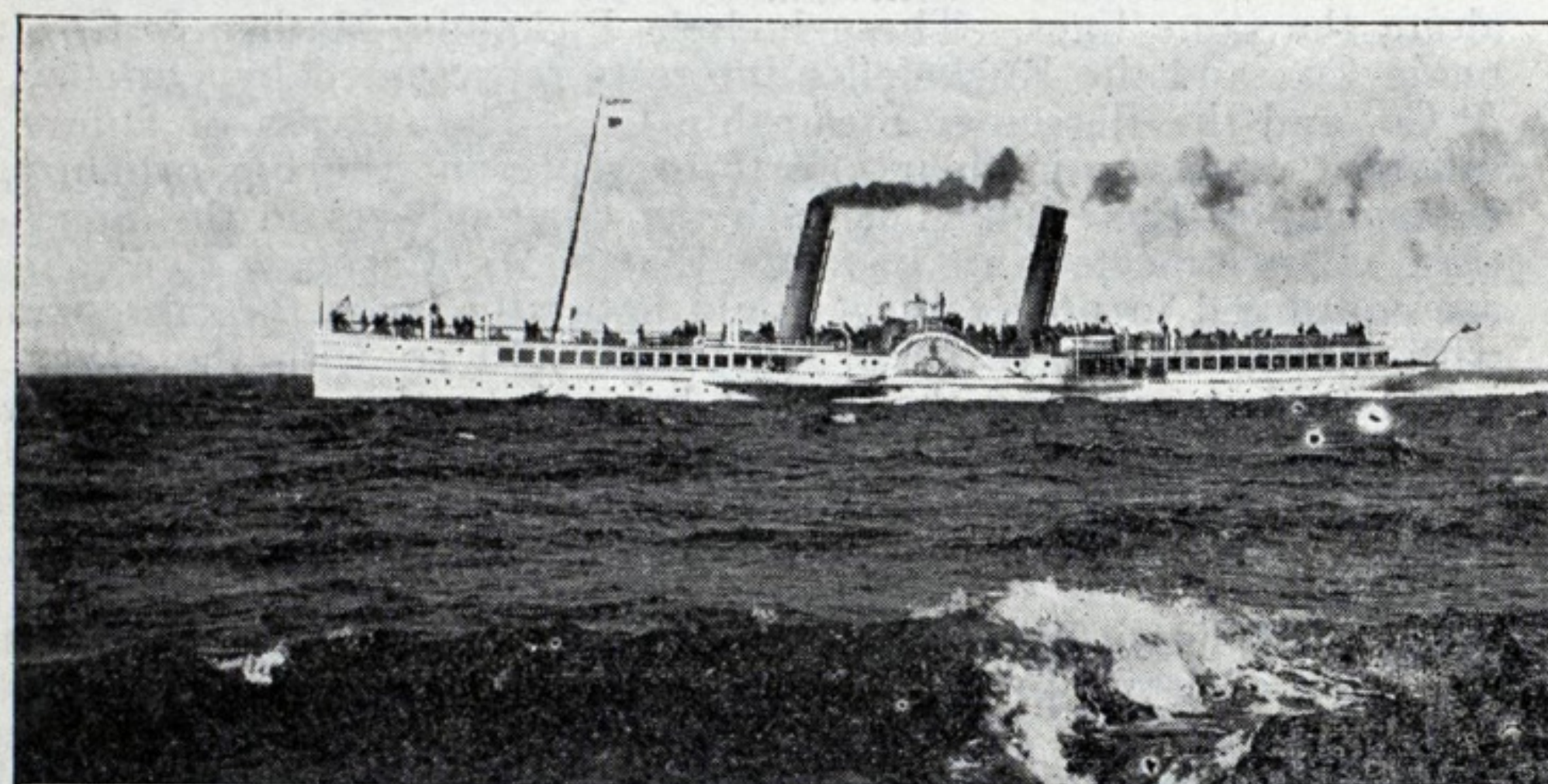
Glasgow, Scotland, March 18.—A glance upon the western portion of a map of Scotland will immediately locate the Clyde firth and river, and, at some distance inland on the banks of the river, the city of Glasgow, the well-known commercial and industrial center of Scotland. Then along the banks of the river and firth west of Glasgow a number of small towns may be noticed, as Renfrew, Helensburgh, Gourock, Dunoon, etc. Some of these towns have their own business and social life, but the workers of many go up to Glasgow itself for their business. This is particularly true during the summers when all of these towns entertain visitors and the wealthier classes from the city inhabit the numberless cottages along the river banks, and both travel daily between the city and their summer homes. The renowned Clyde yachting, which is centered about Dunoon and Hunters Quay, draws many people who add to this traffic, and the long mild summer days set off the attractions of the river banks, a temporary residence.

To handle these commuters and the shifting crowds of the summer holidays, both quickly and cheaply, a specific type of steamer has been developed which may be called the Clyde river steamer. Some thirty or forty of these steamers are owned by three rival railroad companies centering in Glasgow, and run from quay to quay about the river and firth in connection with their various trains. The competition in this factor of the service of these companies is so keen that the highest scientific talent of such Clyde ship designers and builders as Denny Bros. of Dumbarton, Henderson Bros. of Glasgow, and others, has been called upon to advance

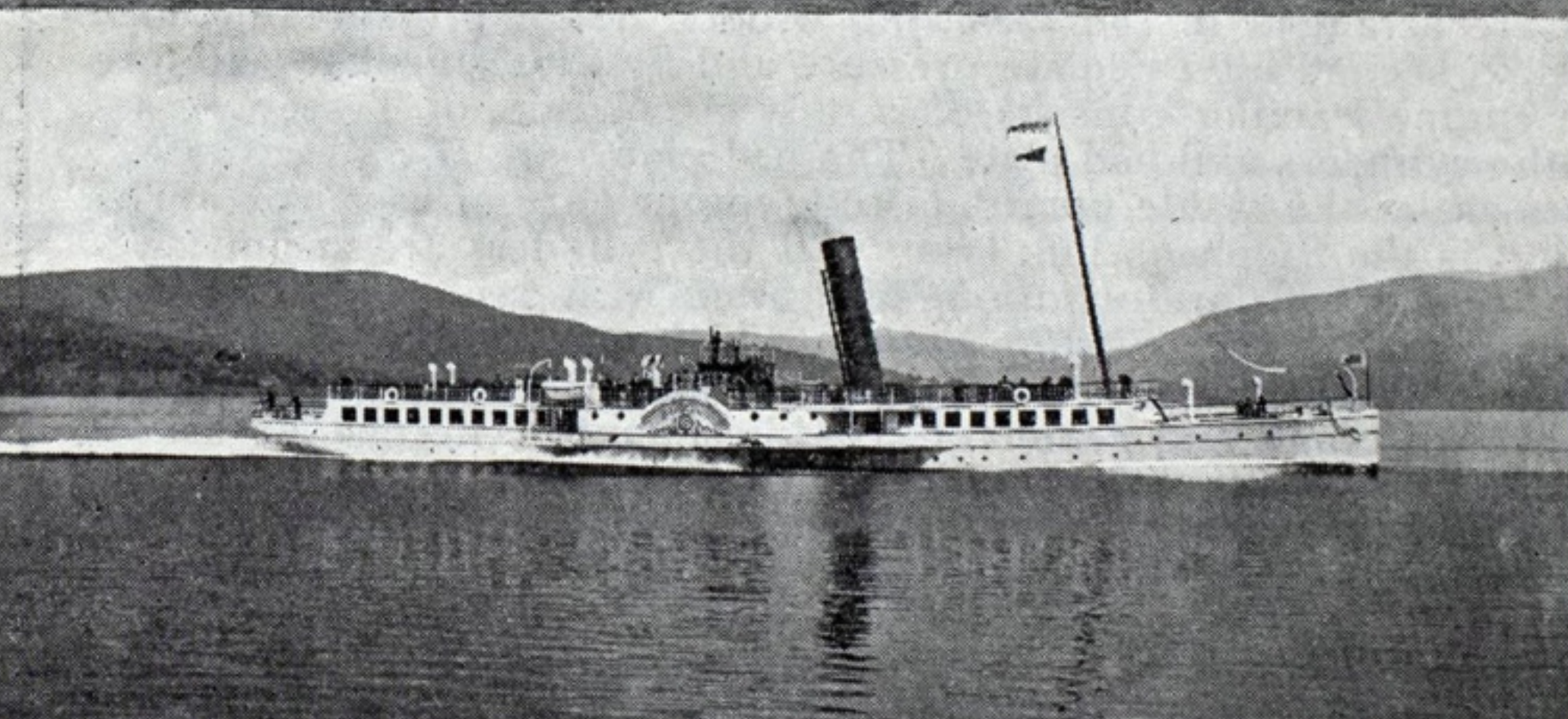
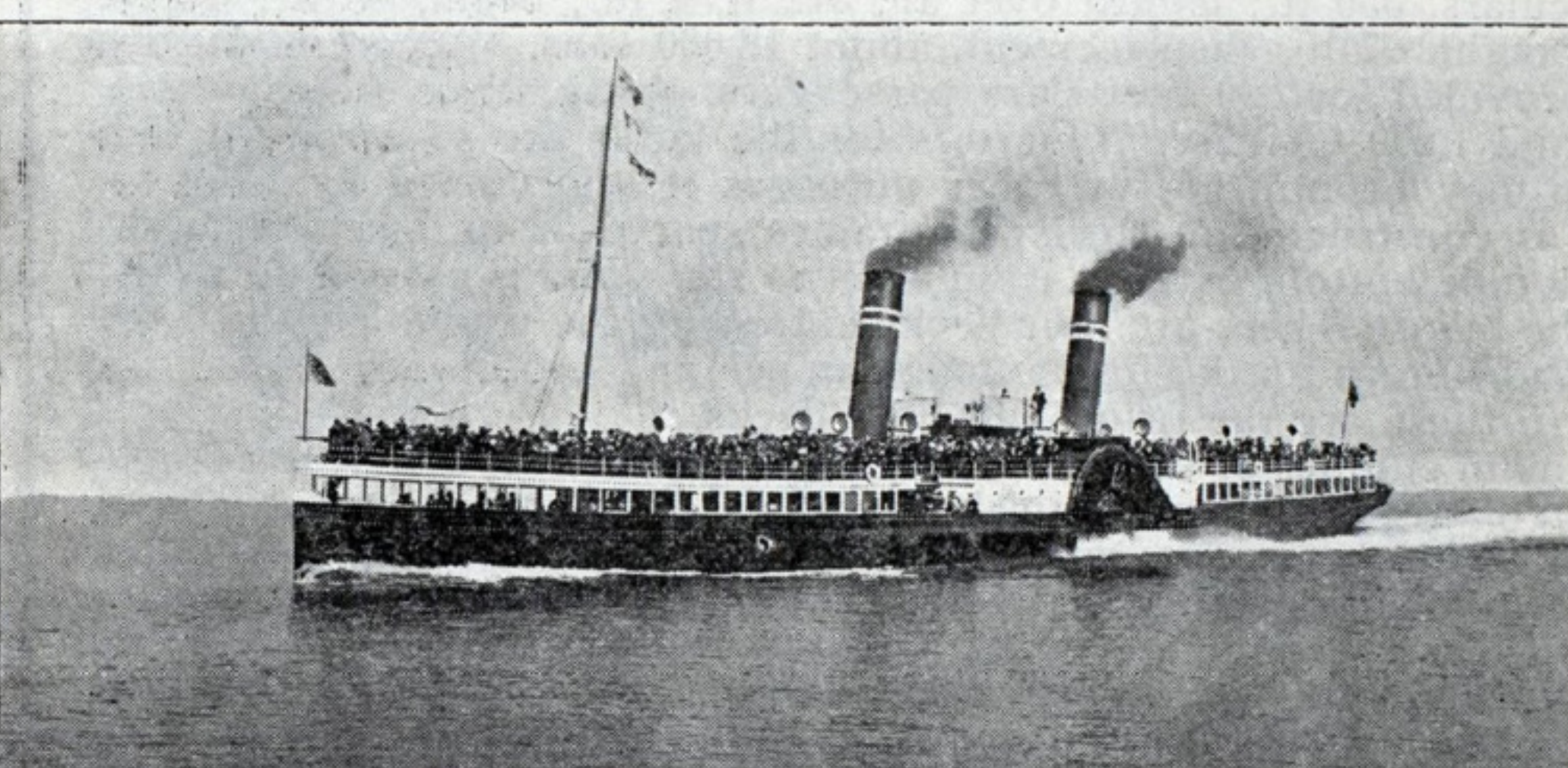
the usual secondary apartments. The first-class saloon, which is reached by a companion just aft of the after funnel on the promenade deck, extends to the after limit of this deck for the whole width of the hull. It is extremely light and well ventilated. Large rectangular plate glass windows allow free view abeam and astern. The sofas are arranged in repeating bays to give a maximum seating capacity for the floor area, and mirrors, curtains, writing tables, etc., are fitted for the comfort and convenience of the passengers. In the forward section of the saloon are a ladies' room and smoking room, both of which are tastefully and appropriately fitted. The first-class dining room, which is on the lower deck, is reached by a broad stairway from the forward end of the saloon. There is seating capacity for ninety persons and both the appointments and the service itself are of the highest class.

Forward of the engine and boiler compartments are the second-class accommodations, which are duplicates of those aft in extent, but, of course, smaller and less elaborate in their fittings. Between these forward accommodations and the collision bulkhead are quarters for the deck crew. About the engine casings on the main deck are exceptionally complete staterooms for the officers, engineers, firemen and stokers. Here also are the galleys and store rooms, while on the broad guards, fore and aft of the paddle wheels, are additional store rooms, water closets for the crew, etc. On the promenade deck between the funnels is a small teak deck house, which contains the captain's room and an office for the purser. From the top of this house the bridge is carried out to the sides of the paddle boxes, which gives a free view to the officer in charge when making a landing.

Incandescent electric lamps are fitted throughout the interior and on the promenade deck arc lights are placed for convenience of passengers when landing, etc., during a night run. A steam steering gear is fitted on the main deck and operated by a hand wheel on the bridge. The anchor gear on the promenade deck consists merely of a capstan, which is used



Glen Sannox.
Dandie Dinmont.



Lord of the Isles.
Minerva.

the type to a maximum of speed, handiness and efficiency. Each company is often building new steamers to distance its rivals and in this they hold a spirit approaching that of the Germans in the trans-Atlantic race.

This type of river steamer can be divided into two classes—those which are run on and about the mouth of the river and those connecting with the towns about the lower reaches of the firth. The latter class is naturally the larger and heavier, while it also has superior and more complete passenger accommodations. The duties of both classes, however, are practically identical and consist of short, quick runs between quays with the minimum of delay at each, the transportation of passengers, and luggage only, and, what is perhaps most eagerly sought, to beat out the steamers of the rival companies. Under this keen competition these steamers have become so similar in design and construction that a description of one of the larger class, supplemented by a few figures of the smaller, will accurately define the whole type.

The Glen Sannox, one of the leading steamers of the Glasgow and Southwestern Railroad Co.'s fleet, will represent most excellently the higher class. The illustration of this craft shows the use of the paddle wheel, the ease of the motion through the water, the well chosen proportions and the thoroughly neat, self contained, ship-shape effect of the whole, which is so characteristic of most British designs. The Glen Sannox is 267 ft. long over all, 30 ft. molded breadth, and 18 ft. deep to upper or promenade deck, which gives a gross tonnage of 610. The speed on official trial was 20¼ knots, and in continual regular service the average, including several stops, stands at a little above 19 knots. The hull is built up entirely of steel to the scantling, of the British board of trade register, and is subdivided into six water tight compartments by integral bulkheads. At all points a study was made to save unnecessary weight, and following from this the displacement is low and the lines of the body fine and well drawn out. Three decks are fitted, the upper or promenade, the main and lower.

As required by the class distinctions of the British railroads there are provisions for handling first and second-class passengers, the accommodations for the second class being forward and those for the first class aft. Both first and second-class accommodations consist of a general saloon on the main deck, a dining room on the lower deck, together with

in connection with a windlass placed on the main deck. Life-boats are carried in number suited to the board of trade requirements, but much dependence, in case of sinking, is placed on the promenade deck seats, which are all fitted with air tanks and would form efficient life rafts if required.

The propelling power is placed in the three midship compartments, so that there is a boiler room forward and another aft of the engine compartment. The two boilers are worked with forced draft on the closed stoke hole system and supply steam at 150 lbs. pressure. One is placed in each compartment and they are of the conventional cylindrical, return-tube marine type. The engines are of the compound, diagonal, direct acting type. The cylinders are arranged side by side and are 34½ in. and 74 in. respectively, with a stroke of 60 in. The crank shaft frames are bolted directly to a foundation plate of the hull and the guides formed to stiffen the whole, so that the vibration at the maximum power is but slight. The surface condenser used is placed transversely under the cross head guides and the pumps are worked by a rocking arm from the cross head of the high pressure piston rod.

The Dandie Dinmont, owned by the North British Railroad Co., may be taken as the representative of the second class. In the illustration the same high qualities of design and proportions can be seen as exist in the larger class. The dimensions of the steamer are: Length, 195 ft.; molded breadth, 22.1 ft.; depth to the main deck of 7.2 ft.; which give an under deck tonnage of 204. The same principles which determined the construction of the hull, the proportions of the lines, the propeller, etc., of the larger class are here used with similar results. As the service is in quiet waters the promenade deck is stopped some 50 ft. short of the stem, and the main deck thus exposed serves as a promenade for the second-class passengers. A second-class saloon occupies the section forward of the boiler under the promenade deck, but there is no associated dining room; in fact, there is no lower deck beyond light wooden flats at such points as are required for officer and crew accommodations. Aft of the engine and boiler space are the first-class accommodations, which consist of a broad light saloon and the usual secondary apartments, but as is the case forward, there is no dining room. However, these steamers are finished in detail and taste of decorations with the same completeness that

exists in the larger class. The engine of the Dandie Dinmont is of the diagonal, direct acting, single cylinder design. The diameter of the cylinder is 48 in. with a stroke of 66 in., this developing a speed of about 16 knots with some forty revolutions.

The paddle wheel has thus far been found to be the most efficient method of propulsion. The service being in comparatively smooth water where little rolling takes place to submerge or emerge the outer ends of the paddle floats, and where the draft is practically constant, leads to the highest natural efficiency of this propeller. Then for the quick, short stops required it is simpler and more effective than the screw, while the broad, short guards about the wheels give an exceptional handiness in clearing a quay, as there is but this short length to swing clear before full power may be given. At present there is a river steamer of a somewhat similar type as these building at the Denny Bros., Dumbarton, works, which is to be fitted with the Parsons' marine steam turbine and screw propellers. The performance of this craft is being looked forward to with deep interest, as a demonstration of the present commercial success or failure of this epoch-making motor.

GEORGE CROUSE COOK.

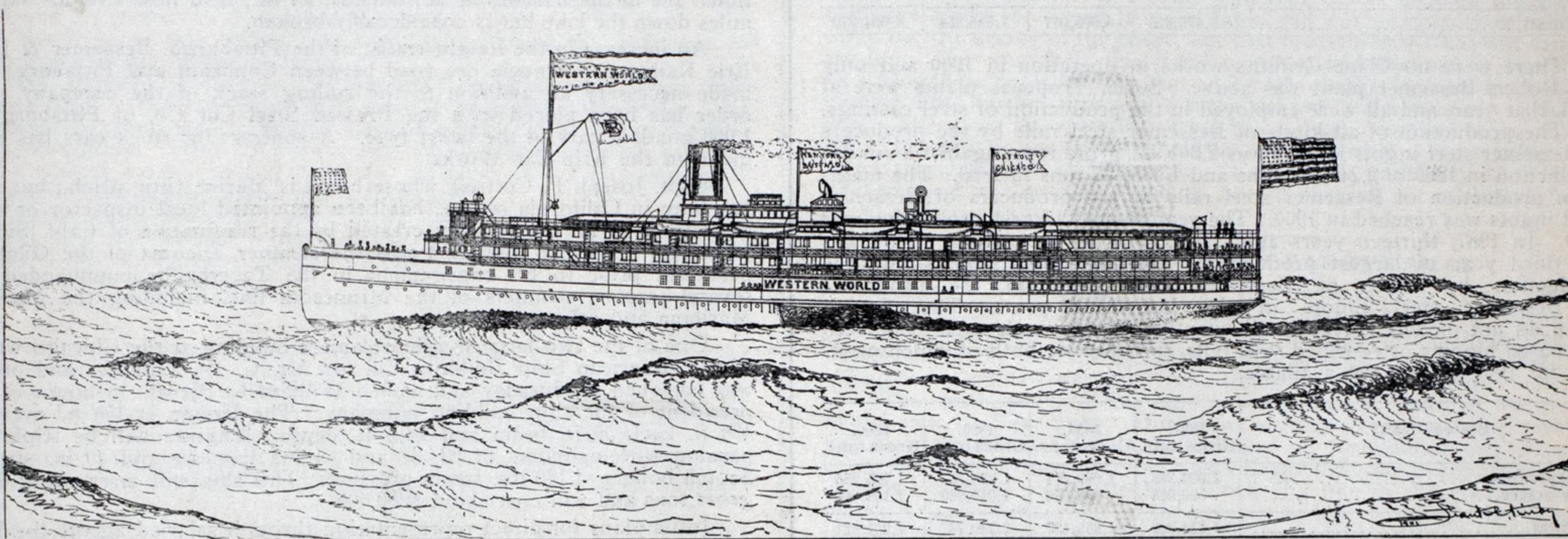
ENGLAND ON THE STEEL CORPORATION.

The United States Steel Corporation continues to be discussed in England from every standpoint. Of course, the main point discussed is its influence upon British trade. Will it or won't it affect it? Fairplay takes about the most hopeful view of the situation and insists that it won't. In its latest issue it says:

"The 'billion dollar' steel trust with which so much preliminary play has been made during the past few weeks, has at last materialized, and the group of financiers who follow the golden lead of Mr. J. Pierpont Morgan, now present to the world the greatest industrial 'combine' that the world has ever seen. It is emphatically a big thing. There are no

world must be considered. On this point, Sir Christopher Furness told the shareholders of the South Durham Iron & Steel Co. the other day that there is little or no cause for alarm, and his optimism has since been supported by Sir Alfred Hickman, M. P., who is no mean authority, and who positively refuses to admit that the trust need alarm British trade. The chief effect of the trust will be to raise the price to the American consumer. The firms of which it is composed will retain their individuality; but they will all work on a common policy, and there will thus be no opportunity of 'cutting' prices. Moreover, the smaller undertakings will undoubtedly be 'frozen out' and, if the clause of the Dingley tariff which protects unfinished steel products is allowed to remain, the same fate will at least temporarily fall upon the foreign competitor. But it is only the trust that will benefit. The American consumer will suffer; so, also, to a lesser extent will the non-American manufacturer, whose trade will certainly be more or less disorganized; and as a consequence, there will spring up a powerful agitation for the abolition of the tariff clause, and if that agitation should succeed the door will be opened to foreign competition and the trust will find it impossible to keep up prices.

"The moral of the trust, however, so far as it concerns ourselves, is much more important than all this. It simply means that British manufacturers, and also, and more especially, British workmen, must improve their methods. If further and still more disastrous inroads upon the home markets are to be prevented, British manufacturers must see to it that they avail themselves of all the latest developments in scientific production, and of every possible means of reducing cost. It must be obvious even to the most optimistic Briton that we cannot any longer afford to live upon our past reputation. We must be in the van. And as with the employer, so with the workman. The British workman must help his employer. The workman in the United States is encouraged, not, as too frequently happens in this country, to do as little as he can for his day's pay, but to put forth the very best that is in him, and to accept the truth of that homely old maxim that half a loaf is better than no bread. It is



DETROIT & BUFFALO STEAMERS

The above picture of the new side wheel steamers, building for the Detroit & Buffalo Steamship Co., at the yards of the Detroit Ship Building Co., was drawn for the Review by Mr. Frank E. Kirby, the naval architect. As the steamers were described in last week's issue it is unnecessary to do more than to give their dimensions. They will be 350 ft. on the water line; 366 ft. over all; 55 ft. beam hull; 80 ft. beam over all; 19.6 ft. molded depth. The vessels will be 42 ft. longer than the City of Erie of the Cleveland & Buffalo Transit Co., and will be further distinguished from that vessel in that they will be equipped with triple expansion incline engines.

fewer than eight concerns mentioned in the articles of incorporation. The Carnegie Steel Co. and the Federal Steel Co. are the most important of these, of course—indeed the 'deal' was only rendered possible by an understanding between Mr. Andrew Carnegie and Mr. Morgan, the moving spirits in these two concerns respectively. But the remaining firms—American Steel & Wire Co., National Steel Co. and others—are by no means unimportant. The combine is designed to 'lick creation.' But will it? Will this huge trust enable its promoters, in the bold words of Mr. Pierpont Morgan, to 'supply the demands of the whole world, and compete with foreign manufacturers in all markets'? The questions are obviously of the most vital importance to ourselves for, thanks to the advantage of high tariff and to other reasons with which we must deal presently, the American steel and iron manufacturers are already able to compete with us much more successfully than is altogether pleasant. And there are the further considerations that the trust will be able, for a time, at least, to strangle the competition of those few firms which remain outside its fold, and by means of economies which combination makes possible, to reduce the cost of production to its lowest possible point. The outlook, it must be admitted, is very disquieting. But there is really no occasion for panic. Sir Christopher Furness, who may fairly be regarded as an authority on the subject of 'combines,' refuses to be seriously alarmed, and his confidence should do something to restore the equanimity of those persons who have permitted the characteristically American 'bluff' of Mr. Pierpont Morgan to get upon their nerves. He is of opinion that the trust will not only fail to have a permanent effect upon the iron and steel trade of the world, but will even lead eventually to a revolt of the American people against the whole system of trusts.

"Probably this is too hopeful a view, but to those who have watched the fluctuations of American politics there is, nevertheless, much to be said in its favor. The last presidential election showed clearly that the people are becoming weary of a system which places them wholly at the mercy of small combinations of capitalists, and enables a few men to grow enormously wealthy at the expense of the many. A few more trusts of the magnitude of this latest example and the protective tariff, which makes the trusts possible, and which is already beginning to decline in popular favor, will become positively intolerable, and the American people may strike a blow for free trade, which would have the effect of rendering such merciless combinations quite out of the question. In the meantime the possible effect of this huge trust upon the markets of the

frequently argued by British employers, in defence of their lack of enterprise in the matter of up-to-date machinery, that their plant is quite equal to the amount of energy which the workman can be induced to exercise. There can be no doubt that there is much truth in this, and herein lies the chief source of danger. What is needed is greater enterprise, better scientific and technical training, improved plant, better methods of management, and, above all, a hearty combination between masters and men for the cheapening of production. All this has been said before, of course. But it cannot be said too often, and if the 'billion dollar' combine helps to enforce the lesson it will assuredly prove to be a genuine blessing to the British steel trade."

FOREIGN BRIDGE AND OTHER STRUCTURAL ORDERS.

Foreign trade of the American Bridge Co. is developing very rapidly. Within the past few days they have received a contract for 20,000 tons of bridges for the Guayaquil & Quito Railroad Co. in Ecuador, South America, and a large group of buildings for the Cananea Consolidated Copper & Silver Mining Co. of Mexico; also several large contracts for manufacturing buildings to be shipped to Australia, and a large railroad bridge to go to the Sandwich islands. It is also announced that their tender for a large foreign contract, exceeding in size anything which they have taken, has been accepted, and that one of their engineers sailed this week to consummate the arrangements. Officials of the bridge company decline to say anything about this matter until the contract is definitely consummated, but admit the facts substantially as above stated, that it is the most important foreign contract they have yet taken. Another foreign order, taken through the company's Schultz branch of Pittsburg, is for a large government warehouse at Progreso, Yucatan.

Home orders of recent date include twelve spans of deck plate girders, 75 ft. long, for the Central Railroad of New Jersey at Weissport, Pa. The company has also secured a contract for a bridge over the South Shrewsbury river at Seabright, N. J. This contract includes furnishing cylinder piers and abutments, four deck plate girder spans, and one draw span 220 ft. long. The bridge will have a 30-ft. roadway, and two 7-ft. sidewalks. The contract is with Monmouth county, N. J.

A new chart, in colors, of Dunkirk Harbor, N. Y., has just been issued and may be had from the Marine Review at 20 cents.

PRODUCTION OF BESSEMER STEEL AND STEEL RAILS.

The American Iron & Steel Association has received, direct from the manufacturers, the production of Bessemer steel ingots and castings and Bessemer steel rails in the United States in 1900. The ingot statistics of the association, printed below, include the production of a few thousand tons of Bessemer steel castings.

The total production of Bessemer steel ingots in 1900 was 6,684,770 gross tons, against 7,586,354 tons in 1899, showing a decrease in 1900 of 901,584 tons, or almost 12 per cent. The production of 1899 was the largest in our history, but it may be equaled in a year or two, although open hearth steel is proving to be a most formidable rival of Bessemer steel. The following table gives our production of Bessemer steel ingots, including steel castings, in the last six years. Of the production last year 6,467 tons were steel castings, against a similar production in 1899 of 3,939 tons.

Years. Gross tons.	Bessemer ingots.	Years. Gross tons.	Bessemer ingots.
1895.....	4,909,128	1898.....	6,609,017
1896.....	3,919,906	1899.....	7,586,354
1897.....	5,475,315	1900.....	6,684,770

The following table gives the production by states of Bessemer steel ingots in the last four years:

States—Ingots.	1897. Gross tons.	1898. Gross tons.	1899. Gross tons.	1900. Gross tons.
Pennsylvania.....	3,060,049	3,402,254	3,968,779	3,488,731
Ohio.....	1,041,541	1,489,115	1,679,237	1,388,124
Illinois.....	943,774	1,105,040	1,211,246	1,115,571
Other states.....	429,951	612,608	727,092	692,344
Total.....	5,475,315	6,609,017	7,586,354	6,684,770

There were no Clapp-Griffiths works in operation in 1900 and only one Robert-Bessemer plant was active. Seven Tropenas plants were at work that year, and all were employed in the production of steel castings.

The production of all kinds of Bessemer steel rails by the producers of Bessemer steel ingots in 1900 was 2,361,921 gross tons, against a similar production in 1899 of 2,240,767 tons and 1,955,427 tons in 1898. The maximum production of Bessemer steel rails by the producers of Bessemer steel ingots was reached in 1900. The year of next largest production was 1899. In 1887, thirteen years ago, 2,044,819 tons were made. This was the third year of largest production. The following table shows the production by states of Bessemer steel rails by the producers of Bessemer steel ingots in the last four years. The figures given do not include a very small quantity of rails made each year from purchased blooms or re-rolled steel rails, statistics for both of which products for 1900 are not yet available.

States—Rails.	1897. Gross tons.	1898. Gross tons.	1899. Gross tons.	1900. Gross tons.
Pennsylvania.....	1,024,386	1,052,771	1,224,807	1,195,255
Other states.....	590,013	902,656	1,015,960	1,166,666
Total.....	1,614,399	1,955,427	2,240,767	2,361,921

At the request of the manufacturers we separated for 1897, for the first time, the production of Bessemer steel rails weighing 45 lbs. and less than 85 lbs. to the yard from those weighing less than 45 lbs. and over 85 lbs. This separation we continue for 1900, as follows:

States—Rails.	Under 45 lbs. Gross tons.	45 lbs. and less than 85. Gross tons.	85 lbs. and over. Gross tons.	Total. Gross tons.
Pennsylvania.....	82,161	784,976	328,118	1,195,255
Other states.....	72,635	820,091	273,940	1,166,666
Total.....	154,796	1,605,067	602,058	2,361,921

The total production of rails in 1900 will include rails made from open hearth steel and iron rails. When all the figures are collected it will probably be found that our total production of all kinds of rails in 1900 was about 2,400,000 tons.

TO PROTECT CHICAGO RIVER NAVIGATION.

Commercial organizations of Chicago are supporting the position taken by the Lake Carriers' Association with reference to regulation of the flow of water to the drainage canal. Following are a couple of letters on the subject forwarded recently to the secretary of war:

Hon. Elihu Root, Secretary of War, Washington, D. C.:—The various interests, as manufacturers, shipping, railways, grain, lumber, coal, elevators and the like, doing business in and along the Chicago river and its south branch, have been put to serious cost and loss, by reason of the large volume of water allowed to flow through the river much of the time since the board of trustees of the Sanitary District of Chicago have turned the water through the drainage canal of the district. The flow of water at times has exceeded 350,000 cu. ft. of water per minute, causing so strong a current that the navigation of the river has been made so hazardous as greatly to curtail business, to the serious damage of all interests.

The current has been found to be nearly three miles per hour at times, a speed that is not consistent with safe navigation of the river under the existing conditions, as has been proved beyond question, and it is the opinion of this association, which is composed of representative men in business, banking and professional pursuits, who are deeply interested in the welfare of Chicago, its interests, our great inland marine and the interests of the middle west and the northwest, that until further improvements are made in the Chicago river, a maximum current of more than one and one-quarter miles per hour should not longer be permitted in the river.

Therefore, the Chicago Commercial Association respectfully petitions

that you take the proper steps to cause the board of trustees to maintain a flow of water through the Chicago river of not more than 200,000 cu. ft. of water per minute. The Chicago Commercial Association.

By Wm. H. Chadwick, President.
La Verne W. Noyes, Secretary.

Chicago, March 16, 1901.

Hon. Elihu Root, Secretary of War, Washington, D. C.: Dear Sir—The Lumbermen's Association of the City of Chicago respectfully represents that the discharge of water through the Chicago river into the drainage channel during the past year seriously interfered with the handling of vessels engaged in the lumber trade. The volume, and particularly the current, were so excessive that great damage resulted at times, not only to vessels, but to other property along the river.

We believe that the river can be navigated safely and speedily only by a reduction in the volume of water to a maximum of 200,000 cu. ft. per minute, and to a speed of not to exceed one and one-quarter miles per hour. We earnestly request, therefore, that you will give such order to the drainage trustees as will cause them to reduce the volume and speed of the current to the maximum above suggested.

V. F. Mashek, Vice-President.

Chicago, March 16, 1901.

AROUND THE GREAT LAKES.

A report from Cheboygan, Mich., is to the effect that teams are still crossing the ice to Bois Blanc island and it is still solid as ever. March weather thus far has been the severest ever known. North-east gales have prevailed with snow. The snow is 8 ft. deep in some places.

Grain in store at the head of Lake Superior—ports of Duluth and Superior—aggregates 15,500,000 bu. compared with 18,250,000 bu. at this time a year ago. Little is doing in the chartering of vessels. Occasionally a ship is engaged at 2 cents, wheat to Buffalo on the opening of navigation. Ice in the harbor, 24 in.; outside, 14 in.; field now extends several miles down the lake but is considerably broken.

An increase in the freight traffic of the Pittsburgh, Bessemer & Lake Erie Railroad (Carnegie ore road between Conneaut and Pittsburg) has made necessary an addition to the rolling stock of the company. An order has been placed with the Pressed Steel Car Co. of Pittsburg for 1,000 gondola cars of the latest type. A contract for stock cars has been given to the Erie Car Works.

Capt. Joseph P. Cottrell, whose home is Marine City, Mich., but who has been in California of late, has been appointed local inspector of hulls at Detroit, to fill the vacancy created by the resignation of Capt. Sidney J. Millen. His last command was the steamer Tacoma of the Gilchrist fleet, but prior to his engagement in the Tacoma he commanded for several seasons steamers of the Minnesota line, including the Maruba, Maritana and others.

One of the two large freight steamers building at the Chicago works of the American Ship Building Co. for Mr. C. W. Elphicke and others was launched Wednesday and named William L. Brown, in honor of the president of the ship building company. The Brown is 450 ft. over all, 430 ft. keel, 50 ft. beam and 28½ ft. depth. Engines will be triple expansion with cylinders of 23, 38 and 64 in. diameter and 40 in. stroke; Scotch boilers of 180 lbs. steam pressure. This ship will carry about 6,400 gross tons and will cost about \$280,000.

In its plans for direct representation through salaried agents the Erie & Western Transportation Co. (Anchor line) is certainly providing the best of facilities for the care of passenger and freight traffic on the lakes during the coming season. In Cleveland, John Maron, who is well and favorably known to the manufacturing and shipping interests, will represent the company, and the dock and warehouse property secured is that formerly occupied by the Detroit & Cleveland Navigation Co., No. 23 River street. This property is easily accessible to teams and the large warehouses afford ample facilities for the handling of freight. In Detroit the dock property just secured is equally advantageous. It adjoins the property of the D. & C. company and has 500 ft. frontage.

Referring to the failure of the river and harbor bill in the last congress, Col. G. J. Lydecker, who is in charge of the important improvements in the St. Mary's, St. Clair and Detroit rivers, says that the loss of additional appropriations will not, of course, stop work entirely. "We shall go on with the work under contract at the Limekilns," said Col. Lydecker, "and with the money available will be able to widen the 300-ft. channel through island No. 1, at the entrance to Hay lake, to 600 ft. Of course, we are always authorized to remove dangerous obstructions in the channels. I believe we have about \$1,750,000 available to use this year, but, of course, the improvement of the St. Clair flats channel (a second canal) cannot be begun, and that is what I regret most in the loss of the appropriations."

Two more Chicago Nautical School students have secured papers for salt water navigation and are to have places on vessels of the Northwestern Steamship Co. (Charles Counselman), building at Chicago for trade between Chicago and European ports. Lieut. Wm. J. Wilson, principal of the Chicago school, was informed recently by telegraph from Boston that Capt. John Crangle and Albert Swanson had been successful in an examination that followed a course of study at Chicago. They are to be rewarded by positions on the Counselman boats, which they were promised in event of success at the Boston examination. Swanson's experience was not equal to that of his fellow master, but by hard work he secured master's papers and goes out as first mate in the Northwestern, which will be the first of the four steamers to leave Chicago—about April 24.

The American Ship Building Co. keeps on paying quarterly dividends of 1¼ per cent. on the preferred stock, and from the manner in which the common stock has been increasing in value of late it is quite evident that the holders of that stock are expecting a share of the profits with the close of the company's year in July. The consolidated yards are certainly accumulating a surplus large enough just now to pay a liberal dividend on the common stock and still leave a big item of undivided profits in the treasury, but the policy of the company in this respect will, of course, be dependent upon the views of the executive board. At a meeting of the executive board a few days ago a dividend of 1¼ per cent. on the preferred shares was declared, payable April 15 to stockholders of record at the close of business April 5. Transfer books will be closed April 5 and reopened April 16.

BRIDGE CASE OF UNUSUAL INTEREST.

RAILROAD COMPANY VIRTUALLY HELD IN CONTEMPT FOR NOT PROPERLY OBSERVING AN ORDER OF COURT TO OPERATE A DRAW-BRIDGE AT ASHTABULA—PROCEEDINGS IN FEDERAL AND STATE COURTS.

One of the biggest men which this country has produced—a man with a head full of hard sense—was Henry W. Sage. Sage was in the vessel business in New York and had considerable coastwise interests. Railroading was in its young and vigorous days and its chief exponent was Com. Vanderbilt, capable and choleric. In course of time Vanderbilt built a bridge across the river with a draw in it, but he had a profound contempt for water transportation, and the manner in which he handled that draw was not all that could be desired. He seemed to think that vessels had no rights which railways were bound to respect. Occasionally he gave Sage trouble. One day Sage sent his son to Vanderbilt's office to tell him that he desired the drawbridge swung at a certain hour, as he had several vessels waiting to go outside. The boy after cooling his heels in Vanderbilt's ante-room for two hours, returned and said that the commodore would not see him. Sage picked up his hat and lost no time in getting to Vanderbilt's office. He brushed back the clerks and entered Vanderbilt's private room.

"Mr. Vanderbilt," he blurted, "I'm Henry W. Sage, and I want to know when you're going to swing that drawbridge?"

Vanderbilt looked up from his desk and slowly surveyed his caller.

"So you're Henry W. Sage, are you?" he replied; "well, I'm going to swing that drawbridge when I get good and ready."

The color left Sage's face. He stared at the commodore mute and impotent with rage. Then he grabbed his hat, turned and left the office, but found his tongue as he reached the door.

"You'll swing that bridge," he said, "by 2 o'clock this afternoon or there won't be any bridge to swing."

Sage engaged at once two of the most powerful ocean-going tugs in New York harbor and instructed them to proceed to the bridge. He told them that they were to simply obey his orders and he would shoulder all responsibility. Then he waited with his fleet of schooners patiently until 2 o'clock for the bridge to swing. It didn't swing, nor were there any manifestations that it was going to swing.

"Batter down the center pier," came the order.

The first tug went at it full tilt and shivered the draw; the second carried it into the stream. Sage's schooners proceeded out to sea. The case, of course, went to the courts.

"I don't know anything about law," said the old man, "but its just horse sense that no one has the right to block a navigable stream. It prohibits trade and prevents the growth of the country. If there isn't a law on the subject there ought to be."

The supreme court held that the old man's views were sound. He triumphed over the railway and the damage done to the bridge was compromised. But the draw swung thereafter with great promptitude.

Another case, in which Russell C. Humphrey of Ashtabula and the state of Ohio are the plaintiffs and the Lake Shore & Michigan Southern Railway Co. is the defendant, has been more amicably settled by the courts. Precisely the same principle is involved as that in which Sage took such heroic measures. Russell C. Humphrey owns property along the river in Ashtabula which, with the growth of the shipping interest at that point, has become of value for docking purposes. It was shut off from the harbor by a railway bridge which was of a stationary character. Mr. Humphrey brought proceedings against the company to compel it to remove the bridge and replace it with one containing a draw. Mr. Burton, now chairman of the committee on rivers and harbors, fought the case for Mr. Humphrey through the courts of the state and through the supreme court of the United States. Both state and federal courts as a rule are jealous of the navigable rights of a nation, and the courts after satisfying themselves that the stream in question was a navigable one, directed that the railway company maintain a suitable drawbridge over it. The railroad company found a bridge that had been constructed for other parties and for a different place, and bought it. The bridge was 365 ft. long, and by putting the pier on one side of the channel it left an arm to be operated over the channel of the river substantially 180 ft. long—an expensive structure altogether out of proportion to the necessities of the case. After the bridge was built the company exercised its own pleasure in its operation. The draw was swung with so much leisure that for the practical development of latter day commerce the bridge might as well have been a stationary one. The plaintiff again had to resort to the courts for relief.

Mr. Burton had become so busy with legislative matters as to preclude the possibility of any further service in a private capacity. The case was therefore given to Mr. Harvey D. Goulder of Cleveland. Mr. Goulder, after reviewing the successive stages of the case through the supreme courts of the state and nation, came to the conclusion that the railroad company in its lame observance of the decree that a suitable drawbridge should be maintained across the river, was directly guilty of contempt of court. Proceedings in contempt were therefore brought against the railroad company on behalf of the state of Ohio and Mr. Humphrey in the state circuit court.

Judge Caldwell has just handed down an opinion which virtually sustains the proceedings in contempt. The railroad company held that as it had submitted plans for the bridge to the secretary of war and the Ohio board of public works, which had been approved, it did not consider that the court had jurisdiction in the premises. In reply to this contention the court maintained that the mode and manner of opening and closing the bridge was never exhibited to these authorities.

The railroad company claimed that it had furnished a bridge that, when swung, would clear the channel of the stream and that they had provided it with a draw which could be opened within a reasonable time. The evidence, however, showed that one man was kept upon the bridge as a draw tender and watchman and that when a vessel whistled for the bridge he went to the yards of the company where the section men were working and gathered a sufficient force to swing the draw. This method caused unreasonable delay and sometimes vessels tired of waiting sought some other dock. The court, while not presuming to dictate with what power the bridge should be swung, declared it to be incontestible that

bridges of that size and character were operated nowadays by steam power or electricity and that it was conclusive that the company had not employed means to open it with reasonable dispatch.

The only excuse the company made for not using steam or other artificial power or employing sufficient men to swing the bridge readily, was that the quantity of navigation did not warrant it. Upon this proposition the court dealt with considerable vigor. It declared that if the railroad should continue to operate the bridge as it had been doing, undoubtedly the demand for the bridge to swing would never be increased, for the delay is such that it is of no practical use to those desiring to use the waters above the bridge.

"The bridge, as it has been operated," says the court, "practically prohibits business being introduced above the bridge; and it seems to us unreasonable and of no weight whatever for the railroad to say that when the relator and others establish business on the waters above the bridge that call for a service that will be of use to them, then they will give them that service, but, that until they have thus established business the present service is all that is necessary; whereas it is clear that with the present service there never can be a business of any consequence established above the bridge and hence the relator and others could never make any use of their property for which it is best adapted."

The railway company also claimed that the proceeding was not a proper one, that if the parties living south of the bridge had been injured by the way in which the bridge was operated their proper action was for damages. To this the court replied that it is not the individual but the state which is interested, for the subject is one vitally pertaining to the interests of the state. The court said that the railway company might have built a bridge sufficient for the place which could have been operated by two or three men, but that as it has seen fit to build thereon a much larger bridge it cannot complain if the court requires it to use a force adequate to operate it. The court held that it was inclined to give the company credit for acting in good faith, and not designedly refusing to carry out the decree of the court; but that nevertheless it has not satisfied the law. The court held that if the company had declined to comply at all it should be punished, but that as it had complied in part it should be given a little further time and a more definite understanding of the decree. The court therefore instructed the railway company to so provide its bridge with power that it would be opened within seven minutes after being signaled to do so by a boat. It was given until May 13 to do so. The railroad is therefore found to be substantially in contempt but is given opportunity to purge itself.

FAVORS THE 1,000-TON BARGE CANAL

A dispatch from Syracuse, N. Y., announces that the New York city advocates of the 1,000-ton barge canal carried the adjourned session of the state commerce convention in favor of their proposition over the objections of the Buffalo delegation, who favored a smaller canal, providing for a craft of 450 tons. The following resolutions were adopted:

"The canal system of the state was the greatest factor in the growth of the state of New York. During its seventy-five years of operation it has been the means, largely, of building up throughout this state the greatest line of prosperous cities and villages that can be found anywhere on this continent. It made New York city one of the greatest of sea ports; it made Buffalo one of the greatest of lake ports. By this growth of population throughout the state it has brought great benefits to all classes of our citizens; to the laboring men, to the farmers and to the merchants in all lines of commercial industry. In addition to its direct influence upon the prosperity of the state it has been such a factor in controlling rates of freight that nowhere on this continent are rates of transportation by railroad and by water so moderate as in this state. The condition of the canal system of this state is most critical. The present and future commercial prosperity of the state is in great danger. Adequate improvements of the canal must be undertaken. Largely increased facilities for water transportation must be secured if the state's commercial supremacy is to be maintained.

"Resolved; That it is the sense of this committee that the commercial interests of the state will be best fostered, promoted and protected by the construction of the 1,000-ton barge canal; that a committee of nine, together with the president and secretary, be appointed by the president of this convention, which committee shall prepare and present to the legislature and governor the further reasons for its conclusions."

President Kernan appointed the following committee, which, it is expected, will go to Albany this week: George Clinton of Buffalo, Frank Brainard of New York, Aaron Vanderbilt of New York, Hon. John Loughlin of Buffalo, Willis H. Tennany of Mayville, Samuel H. Beach of Rome, Hon. John D. Kernan of Utica, Frank S. Gardner of New York.

IRON AND STEEL EXPORTS.

Reports from the bureau of statistics, treasury department, regarding exports of iron and steel show that the total for eight months ending with February, 1901, is \$6,500,000 in excess of the unparalleled figure of last year, and nearly three times the total for the eight months ending with February, 1891—an increase of 10 per cent. in a single year and 333 per cent. in the decade. In the eight months ending with February, 1891, iron and steel formed but 3 per cent. of the total domestic exports from the United States; in the eight months just ended they form 8 per cent., being \$81,553,132, against \$75,053,768 in the corresponding months of the fiscal year 1900, and \$18,823,384 in the same months of 1891. In 1891 no exports of electrical machinery were recorded, but by 1900 the figures for eight months' transactions had reached about \$2,500,000, and for the eight months ending with February this year amounted to \$3,777,673, an increase of \$1,345,000 in a single year. Exports of steel rails increased from \$395,484 in the eight months ending with February, 1891, to \$4,818,226 in the corresponding months of the fiscal year 1900, and \$6,889,079 in the same months of the fiscal year 1901.

The Nickel Plate road will sell excursion tickets to students holding certificates from school principal, at one and one-third fare for the round trip, account the Easter vacation. Tickets available day before school closes, the closing day and day immediately after, the return limit to cover period of vacation. Write, wire, 'phone, or call on nearest agent, C. A. Asterlin, T. P. A., Ft. Wayne, Ind., or E. A. Akers, C. P. & T. A., Cleveland, O.

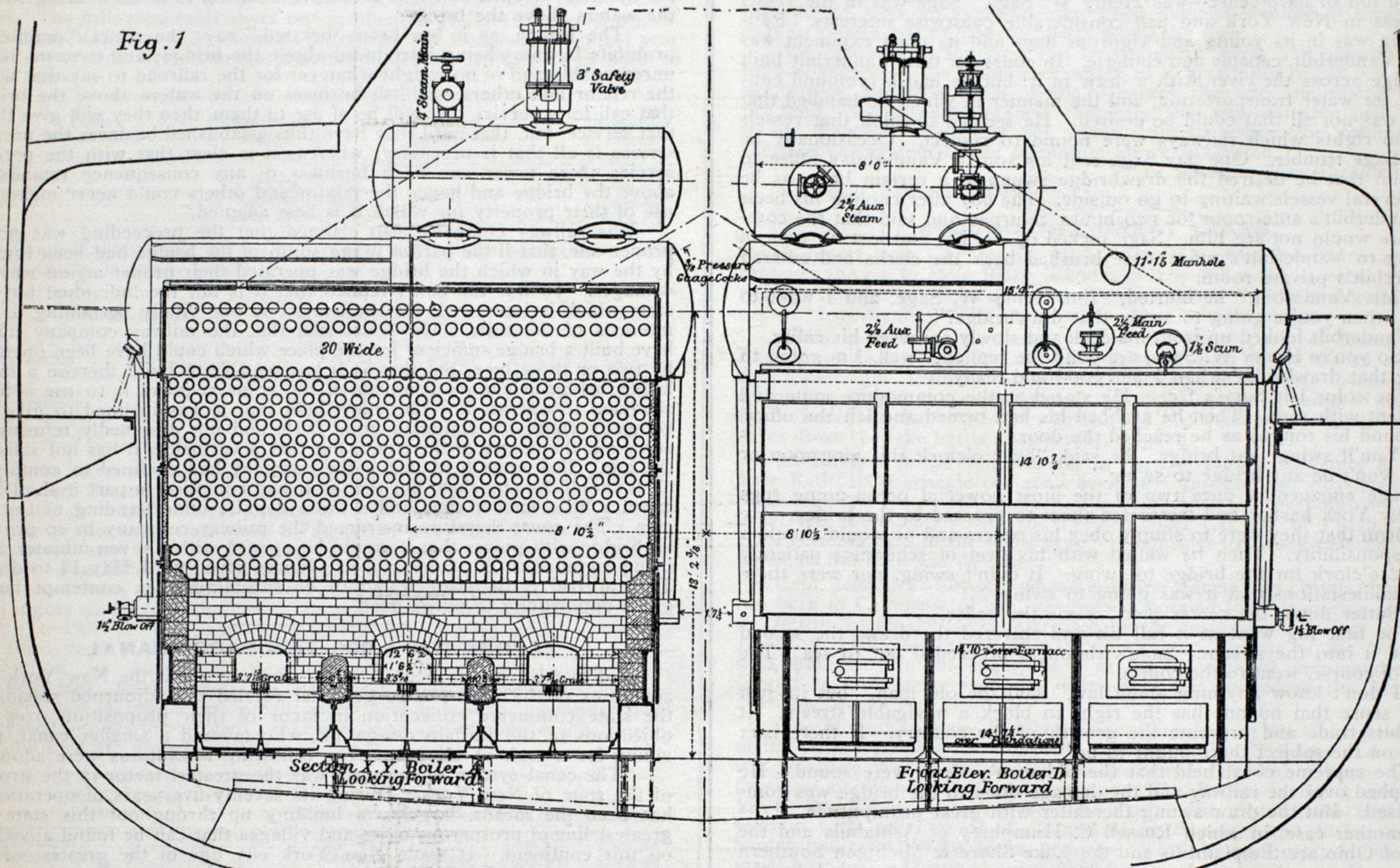
BOILERS OF THE MARTELLO.

A DESCRIPTION OF GENERATORS OF THE BABCOCK & WILCOX WATER TUBE TYPE WHICH WERE SUBSTITUTED FOR RETURN-TUBE BOILERS.

The Martello is a steamship owned by Messrs. Thomas Wilson, Sons & Co. of Hull, and trading between New York and the Humber. She is a single screw ship of ordinary construction, with triple compound en-

of 150 lbs. per square inch, and had a total collective heating surface of 7,000 sq. ft. The cylinders of the engines were 31 in., 50 in. and 80 in. in diameter, by 57 in. stroke. Engineering of London in discussing the replacement of the boilers says:

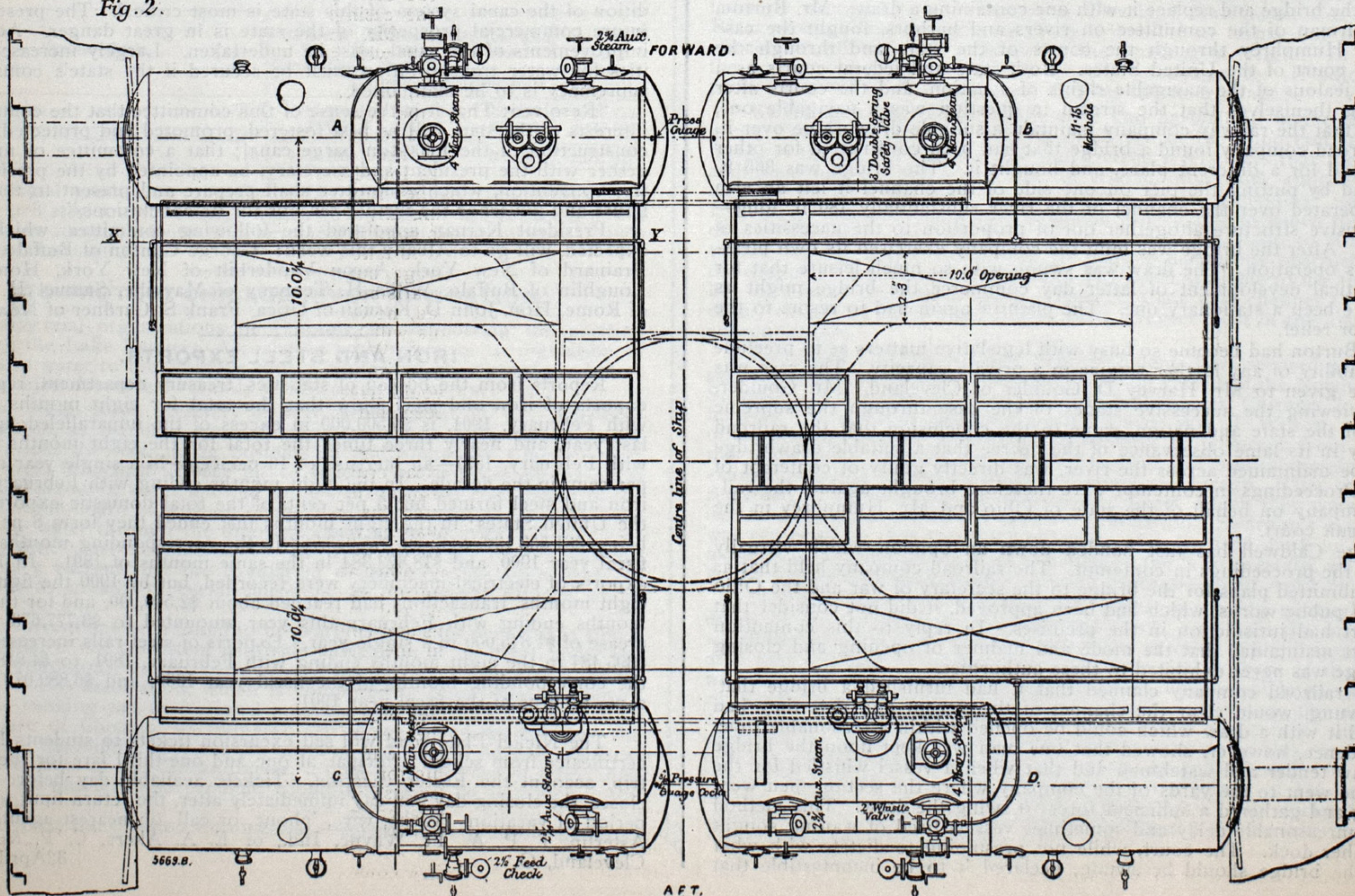
It having become necessary to replace the old boilers, the owners, acting on past experience, determined to put in Babcock & Wilcox boilers; this being the ninth of their vessels so fitted. These new boilers are of the marine type, which differs somewhat from the perhaps better known land boilers of the same name. These are, as in the original installation,

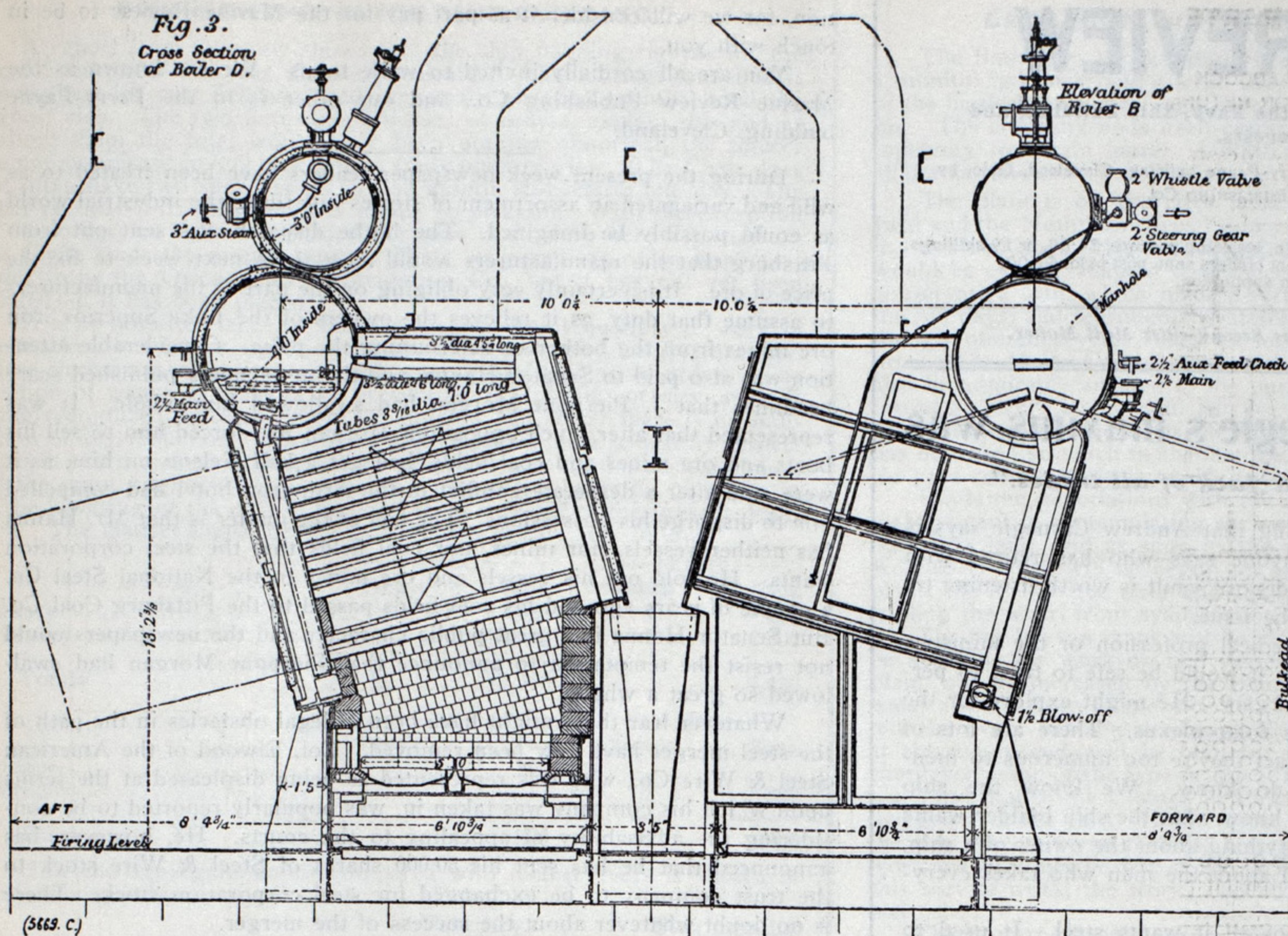


gines. The point of interest about the vessel is that having been fitted with return-tube boilers, these have been taken out and water tube boilers of the Babcock & Wilcox type have been substituted for them. The original shell boilers were four in number. Two of them were single-ended, each 12 ft. in diameter by 9 ft. 1 1/2 in. long, whilst two were double-ended, each 12 ft. in diameter by 16 ft. 3 in. long. They were worked at a pressure

Fig. 2.

four in number, each having a heating surface of 2,685 sq. ft., and a grate area of 55 sq. ft. The total heating surface is, therefore, 10,740 sq. ft., or 3,740 more than with the old boilers. These boilers are grouped together, two abreast and back to back, so that there are two firing platforms, one at the forward and one at the after end of the boiler compartment, as shown in Fig. 3. The new boilers are pressed to 220 lbs. to the inch, the

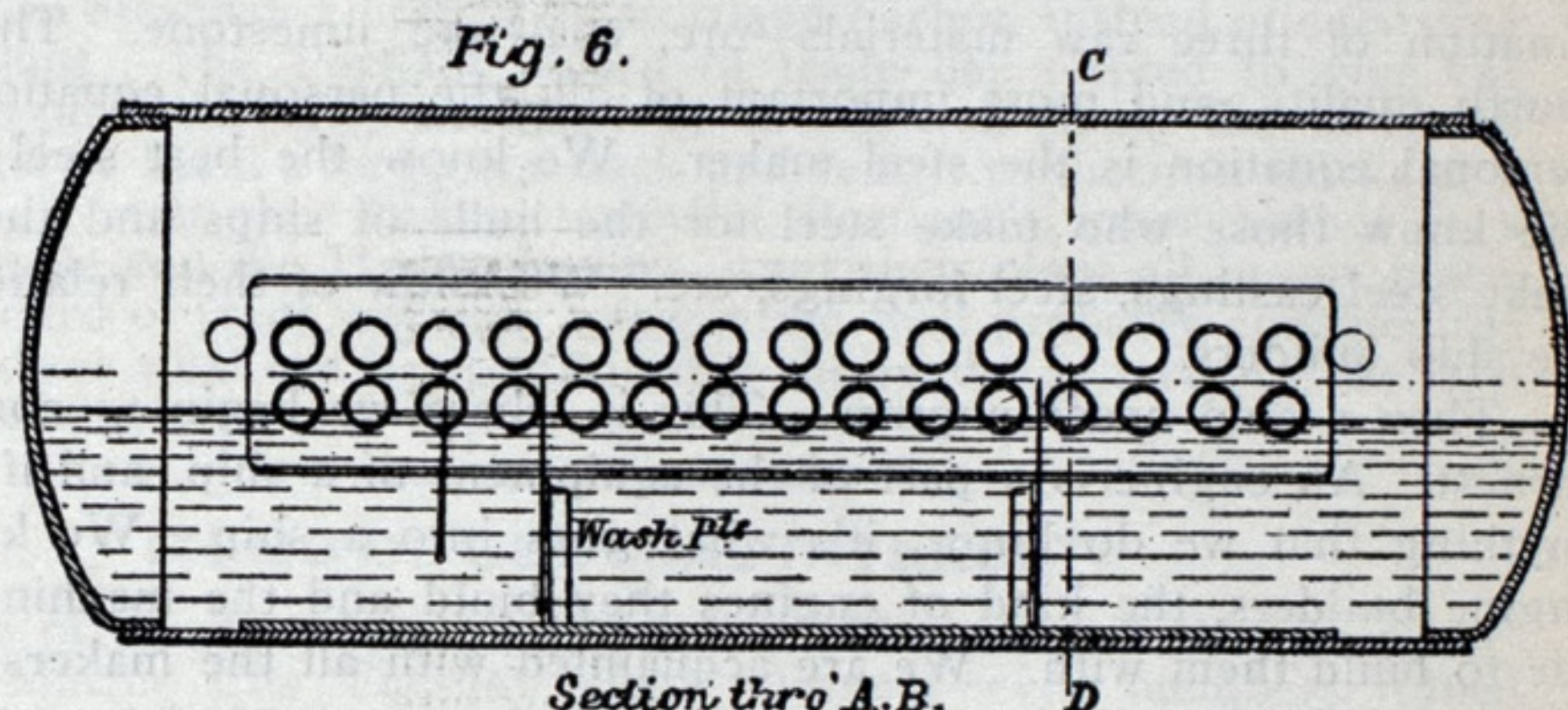
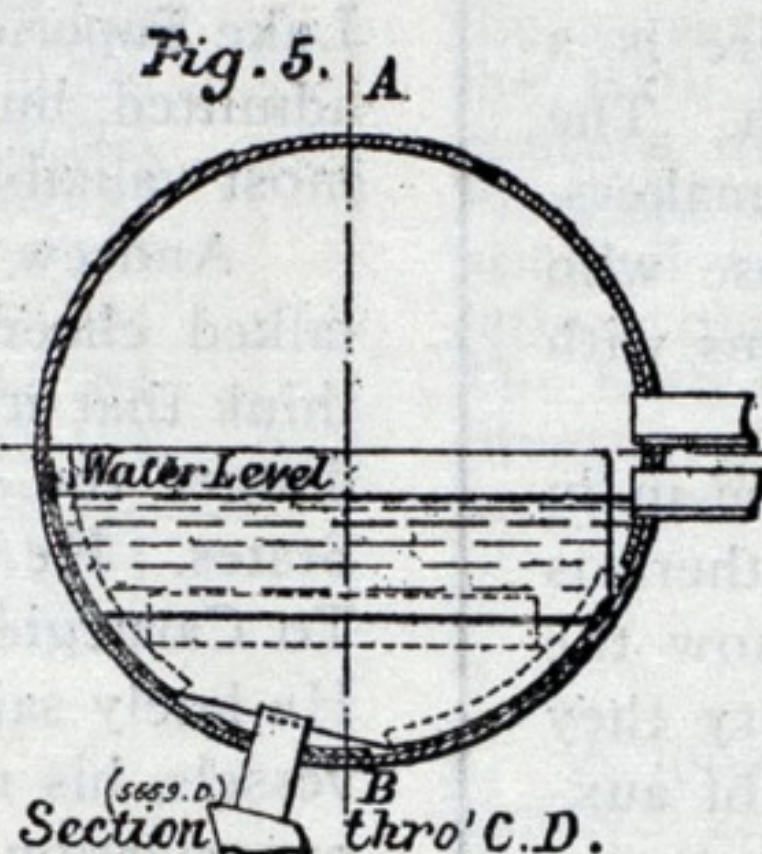
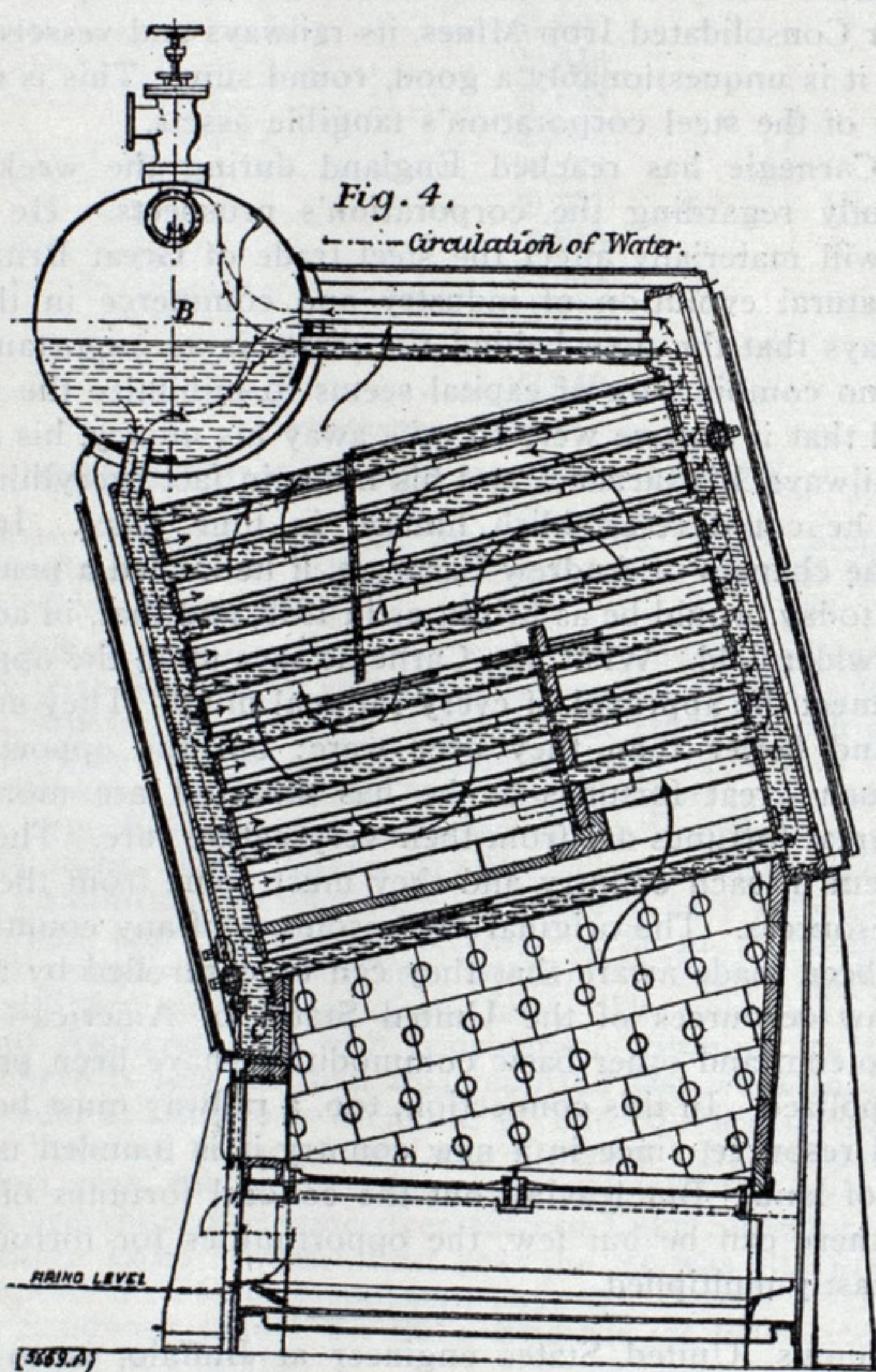




The Martello was taken out of the Humber to run a trial on August 23 last. Unfortunately, this trip was brought to a premature conclusion by the heating of a piston rod and slipper guide. This was the trial to which reference was made by the Pall Mall Gazette, when the failure was made to appear as if due to the water tube boilers. Through the courtesy of the owners—Messrs. Wilson, Sons & Co.—we were on board the vessel at the time, and can bear testimony to the fact that the boilers worked on this occasion without giving any trouble, and that the cause of the trial being broken off was exactly that above given. We were in the engine room at the time of the mishap, and speak from personal observation. We should not have referred to the incident were it not that it illustrates the manner in which the public is but too often misinformed.

The trial was renewed a few days after, and the following details have been communicated to us:

The Martello left the Alexandra dock, Hull, for trial about 9 a. m., and proceeded to the measured mile off Withernsea. Here a mean speed with and against tide, of over 14 knots was registered, full speed then being maintained for four hours, the throttle valve being wide open and the links in full gear. Afterwards other runs on the mile were made at lower speeds. The coal used was South Yorkshire. The draft at the root of the funnel was .4 in. of water pressure, and pyrometer readings



increase of 50 lbs. on the old boilers necessitating an alteration in the size of cylinders. A liner was therefore put in the high pressure cylinder, and the dimensions were brought to 25½ in., 50 in. and 82 in. in diameter by 57 in. stroke. Each boiler is thirty sections wide, and has 448 solid drawn steel tubes. Of these 390 are 3-3-16 in. in diameter by 7 ft. long, and fifty-eight are 3½ in. by 4 ft. 5 in. long. The thickness of the metal varies from 7-32 in. As will be seen, there are two drums to these boilers, a practice that is not usual. The top drum, or steam receiver, of each boiler is 3 ft. in diameter by 8 ft. long, and the lower, or steam and water drum, is 4 ft. in diameter by 15 ft. 4 in. long. There are three fire doors to each boiler, and the grate bars are 5 ft. long. The general arrangement is well shown in the illustrations, Figs. 1, 2 and 3, these giving a cross-section, plan and longitudinal section of the boiler compartment.

The boiler room bulkheads not having been shifted, the new boilers have had to go into the same space as the old ones, excepting that the side bunkers formerly fitted have been done away with, the pairs of new boilers occupying more space athwartship but less fore and aft space. A cross bunker has, therefore, been put in, but this is not quite so big as the two side bunkers were collectively. There has, however, been a notable saving in weight, in spite of the great increase in heating surface. The old return tube boilers weighed, with mountings and water, 260 tons; whilst the new water tube boilers weigh 145 tons, so that there is a gain of 115 tons, which can be devoted to cargo or other purposes.

of the temperature of the gases at the root of the funnel, taken at 15-minute intervals, averaged 590° F. The trials were reported to be in every way satisfactory, the casings were cool and the boiler room at a comfortable temperature. Mr. Hide, superintending engineer for the owners, expressed himself well satisfied with the performance of the boilers.

The Martello left Hull for New York on Sept. 2 last, this being her first voyage after fitting the new boilers. Bad weather was experienced, but the voyage is reported to have been uneventful, so far as the boilers were concerned, as they worked exceedingly well. On opening up in New York their condition was found to be "all that could be desired." The ship left New York on her return voyage on Oct. 2 and reached Hull without the boilers giving any trouble. On being opened up they were found to be in "first-class condition."

It had been intended to take note of the coal consumption and power developed during the voyage, but owing to difficulties, not connected with the machinery or boilers, arising, this part of the programme was not carried out. We understand, however, it is only postponed, and after the tests are made full details will be given out. During the vessel's stay in Hull Messrs. Babcock & Wilcox have fitted their standard baffling arrangement to direct the gases among the tubes in a way that will induce economy. This work would have been done before the vessel started on her voyage had it not been that the owners urgently required the service of the vessel.

The Hamburg-American cruising yacht Prinzessin Victoria Louise has many new and extraordinary features about it. The management has utilized electricity in numerous interesting ways. The gymnasium contains many unusual appliances which are operated by electricity. One of the appliances affords all the varieties of horseback exercise, a conventional saddle, stirrups and other accessories being provided, and with them suitable adjusting mechanism, so that the whole outfit can be given more or less violent vertical and slightly horizontal reciprocal movement through a system of cams and connecting rods simulating very closely the motion of an animal in life. Electrical massage instruments are also provided.

President B. N. Baker of the Atlantic Transport service is of the salt of the earth. He gave the steamship Maine as a hospital ship to England during the South African war without charge. He officered, manned, stored and coaled the ship for sixteen months at an expense of \$5,000 per month. Now that the English women who undertook to equip the vessel and provide nurses have failed in that duty he is doing that too. During the Spanish-American war Mr. Baker gave the hospital ship Missouri to the American government and maintained it. Evidently with Mr. Baker humanity and not country comes first.

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One of Andrew Carnegie's maxims was

"Be king in one line, not a Jack of all trades."

We quote this maxim because everything that Andrew Carnegie says is worth listening to. Anything that anyone says who has retired with \$210,000,000 worth of bonds in his safe deposit vault is worth listening to. Moreover, the maxim is pertinent to the issue.

We don't know much about the medical profession or the ministry. There isn't a person in this office whom it would be safe to trust to perform an operation in major or minor surgery. He might explore for the appendix and succeed in removing the solar plexus. There are lots of other things that we don't know. In fact they're too numerous to mention. But there is one thing that we do know. We know the ship building field and its allied trades. We know what the ship builder wants and where he can get it. We know everything about the owner of a ship, about the man who builds the ship and about the man who takes everything that goes into a ship.

A ship is a hungry thing. First of all it wants steel. It used to want wood, but it's got over that. It wants steel now. Steel is a combination of three raw materials—ore, coal and limestone. There is a fourth quality, and most important of all, the personal equation. The personal equation is the steel maker. We know the best steel makers. We know those who make steel for the hulls of ships and those who make steel castings, steel forgings, etc. We know of their relations with the ship builders.

Then a ship needs engines. This is where we begin to come in in earnest. An engine is a part of the equipment of a ship, and if there is anything that we do know, it's what goes into a ship. We know the engine builders, the kind of engines they build and the machinery they use to build them with. We are acquainted with all the makers of auxiliary machinery.

A ship needs screws. Nothing like manganese bronze for propeller wheels. We know those who make it.

A ship needs helm indicators to show the position of the rudder. Nothing like knowing where you're headed in navigation.

A ship needs lubricating oil or graphite. Friction's bad for the ship's insides. There's enough friction outside. Ships go nowadays like all get-out, but they'd go a deal faster if it wasn't for that self same friction of the water.

Ships need rigging. Wire is contesting the issue with hemp. We know the advantages of both.

A ship needs pumps. She needs them all the time, but sometimes she needs them more than anything else. Pumps (wrecking pumps) are better than prayers when a ship hits a reef.

A ship needs steam gauges. A boiler never goes off but once, but, like Mercutio's wound, 'tis enough.

A ship needs lamps, search-lights, life-boats and cork jackets, mattresses, cushion and bedding, fans, windlasses and capstans. We know who makes the best.

A ship needs stoves. We know concerns that have stoves to burn.

There are many other things which a ship needs which it is necessary to catalogue.

And now we strike our gait—to catalogue.

The best way to catalogue is to advertise in the Marine Review. It goes every week to the man who needs the things you make. It goes further—gives to you upon request, and often without requesting it, all the information it has secured through keeping in touch with the interests above referred to.

The next best way to catalogue is to issue a catalogue and to let us make the catalogue for you.

We don't make cheap catalogues. We make good ones at a fair price. We will evolve the catalogue, if you like, without putting you to any bother whatever. We will design it; we will illustrate it; we will provide its letter press; we will engrave it, and we will print it. All we want is fair remuneration for our work.

Or you can furnish the photographs and letter press matter and we will put it together and print it—and this we will do for small remuneration,

for we will consider it as part pay for the Marine Review to be in touch with you.

You are all cordially invited to write to us. We are known as the Marine Review Publishing Co., and our office is in the Perry-Payne building, Cleveland.

During the present week newspaper readers have been treated to as wild and variegated an assortment of stories regarding the industrial world as could possibly be imagined. The blithe dispatch was sent out from Pittsburg that the manufacturers would meet there next week to fix the price of ore. It is certainly very obliging on the part of the manufacturers to assume that duty, as it relieves the owners of the Lake Superior iron ore mines from the bother of determining the price. Considerable attention was also paid to Senator Hanna, and the newspapers published scare headlines that J. Pierpont Morgan had swallowed him whole. It was represented that after much opposition Morgan had forced him to sell his boats and ore mines and coal fields, had got a half Nelson on him, as it were, and after a desperate conflict in the Arlington hotel had compelled him to disgorge his possessions. The fact of the matter is that Mr. Hanna has neither vessels, nor mines, nor coal fields that the steel corporation wants. He sold out his vessels and ore mines to the National Steel Co. a couple of years ago and his coal fields passed to the Pittsburg Coal Co. But Senator Hanna is a great public character and the newspapers could not resist the temptation to announce that Pierpont Morgan had swallowed so great a whale.

Whatever fear there might have been of legal obstacles in the path of the steel merger have now been removed. Col. Elwood of the American Steel & Wire Co., who was represented as being displeased at the terms upon which his company was taken in, was popularly reported to be considering the advisability of appealing to the courts. He, however, has announced that he has sent his 30,000 shares of Steel & Wire stock to the trust company to be exchanged for steel corporation stock. There is no doubt whatever about the success of the merger.

No statement has yet been made about the terms upon which the Lake Superior Consolidated Iron Mines, its railways and vessels, has been admitted, but it is unquestionably a good, round sum. This is one of the most valuable of the steel corporation's tangible assets.

Andrew Carnegie has reached England during the week and has talked cheerfully regarding the corporation's prospects. He does not think that it will materially affect the steel trade of Great Britain or endanger the natural evolution of industry and commerce in the United States. He says that the man behind the trusts is as important as ever. To Carnegie no combination of capital seems to minimize the personnel. He lately said that if anyone were to take away his money, his mines, his vessels, his railways, his furnaces and his mills, in fact everything but his organization, he could re-establish himself in four years. In London he said that the chances of Andrew Carnegie, if he landed a penniless boy in New York today, would be as bright as in 1848, and that, in addition, he would have a wider field. What Mr. Carnegie says upon the opportunities of today will meet the approval of every rational mind. They are broader and bigger and better than they ever were; but the opportunities to accumulate such great fortunes as he has amassed are more limited. Indeed such great fortunes are from their very nature rare. There can be but few of them in each country and they must come from the exploitation of raw resources. The original raw resources of any country are few and we have been made aware that they can be controlled by a very few men. The raw resources of the United States of America—ore, coal, iron ore, petroleum and other basic commodities—have been pretty thoroughly monopolized. In this connection, too, a railway must be regarded as an original resource, since in a new country it is founded upon enormous grants of land. But leaving out the colossal fortunes of which in any country there can be but few, the opportunities for fortunes of fair degree have vastly multiplied.

Major Symons, United States engineer at Buffalo, is to in future attend to the duties of the United States engineer office at Oswego, in addition to his present duties in the Buffalo district. Orders from Washington on this score are prompted by the fact that the failure of the last congress to pass a river and harbor bill leaves the Oswego office without a great deal to do. But if the Oswego office was equal to Buffalo it is more than probable that Major Symons, with the energy and push he has shown in the conduct of work entrusted to him, would find a way of attending to its affairs. It is too bad that the heads of the engineer corps do not see fit to pick out a few more men of the Symonds kind for work in the lake region. Instead of allowing public works to drag along in a manner entirely removed from modern business methods they would at least manage to spend appropriations as fast as they are granted and at the same time give the government the worth of its money.

A Chicago dispatch says that the drainage canal trustees hope before the opening of navigation to reduce the flow of water through the Chicago river to such a degree that there will be no complaint from the shipping interests. They are working on a plan which it is expected will satisfy the requirements of the state of Illinois as to the flow of water and still safeguard navigation.

TWO MONTHS' CLYDE SHIP BUILDING.

A report from Glasgow shows that the ship building returns for the second month of the year make two records. The tonnage launched is the highest for any February and they make the two months' total the highest also. The two first class cruisers, of course, explain this and as without them the total would have been nothing abnormal, the figures are not significant in any way from a trade point of view. The Clyde does not often have two such vessels in one month, still less in one day. The other record—if it is a record—is hardly so pleasant. With the exception of one order, no definite contracts for new work have been reported on the Clyde since the month began. There were rumors of an important order from the Orient Steam Navigation Co., but it has not yet been located—if it has been placed.

It is an admitted fact that there is a considerable quantity of work in the market, but wages and material are alike dear, and freights are low. These circumstances entirely preclude any general placing of orders. The position of wages as a factor in preventing the placing of new work is being recognized more and more by builders, but so far there is no indication of any reduction. Employers and employed have a healthy respect for each other, and no change will be proposed without due consideration. All the same, employers look quite as much to the lowering of wages as to the lowering of the cost of material for a way out of the present deadlock. The district totals for the two months of this year follow:

	—Clyde.—		—Forth.—	
	Vessels.	Tons.	Vessels.	Tons.
January	7	13,020	1	150
February	15	60,000	1	1,300
Totals	22	73,020	2	1,450

	—Tay.—		—Dee.—	
	Vessels.	Tons.	Vessels.	Tons.
January	1	800
February	2	300
Totals	1	800	2	300

How the aggregate stands compared with former years is shown in the following table:

	February.	Two months.
	Tons.	Tons.
1901.....	61,600	75,570
1900.....	29,516	60,720
1899.....	29,008	60,805
1898.....	28,692	43,582
1897.....	16,273	30,425
1896.....	39,391	56,844
1895.....	19,816	41,784
1894.....	25,064	43,153
1893.....	15,922	28,722
1892.....	35,247	51,271
1891.....	23,040	41,720

CONDITION OF ICE ON THE LAKES.

Mr. Norman B. Conger, marine agent of the United States weather bureau at Detroit, makes the following report under date of March 26 of the condition of ice in the lakes:

"Reports indicate the ice has been materially decreased by the warm weather of the past three days, and there is less ice in all the lakes. Over western Lake Superior the ice field is packing at Duluth, with open water off Two Harbors and Eagle harbor. The ice field continues heavy over eastern Lake Superior. Conditions have not changed in St. Marys river, except that a large field of ice is reported at the mouth of the river extending out of sight. Over Green bay the snow is melting off the ice, otherwise the conditions are unchanged. There is very little ice reported in Lake Michigan, and the ice has decreased to 20 in. at Mackinaw. The large ice fields remain in the southern portion of Lake Huron, and the ice bridge is still firm at the foot of the lake. The rivers are open from Port Huron to Amherstburg, with considerable running ice in the Detroit river. There is less ice than was reported last week in Lake Erie, and the large field at Buffalo is breaking up and running down the river. There is very little ice reported in Lake Ontario. In comparison with same period last year, there is less ice reported in all the lakes, although the conditions are about the same over eastern Lake Superior, St. Marys river and southern Lake Huron. Last year the ice was still firm in Lake St. Clair, except at the extreme southern end, and Detroit river was open only down to Sandwich point. In Lake Erie the ice field extended from Cleveland, eastward to Buffalo.

MASTERS AND ENGINEERS OF LAKE VESSELS.

Ludington, L., Alpena, Mich.: Steamer—Alaska, Capt. L. Ludington, Engineer Geo. Miller. Schooner—India, Capt. Hans Hansen.

Lee, A. R., Gen. Mgr., Star-Cole Lines Steamers, Detroit: Steamers—Idlewild, Capt. Jos. Lockridge, Engineer David Maxwell; Arundell, Capt. John Robertson, Engineer C. H. McCarten.

Loud, H. N., Oscoda, Mich.: Steamers—John B. Ketchum 2nd., Capt. Martin Christy, Engineer Clark Ford; Seattle, Capt. Hiram Still, Engineer Alonzo Smith; Petrel, Capt. ———, Engineer, ———.

According to F. L. Chase, bridge engineer for the New York Central Railroad, that road expended last year nearly \$2,000,000 for bridge work, and this year will expend an equal amount. A few days ago the company asked for bids on 28,000 tons of steel work, comprising several hundred spans. This is the largest single contract for bridge material ever let by a railroad company in the United States, and the contract for the whole lot was awarded to the American Bridge Co.

To Chicago via B. & O.—Daily trains, through sleeping cars, 6:35 and 9:35 p. m. \$8.50 first, \$7.00 second class. Mar. 28.

BATH IRON WORKS SEEKING MORE ROOM.

The Bath Iron Works, Bath, Me., have on hand three torpedo boats, a monitor, a cruiser and a large tug, have contracted for the construction of the battleship Georgia, and have contracts for merchant steamers pending. The company finds itself cramped for room and is exercising all its ingenuity to obtain more. A Bath dispatch sets forth the condition of affairs as follows:

The plant is on the river front between the Maine Central freight yard and the Houghton Bros.' ship yard, with a river frontage of only 750 ft., of which about 250 ft. is occupied by buildings. The Houghton yard would be exactly adapted to the needs of the works, but it belongs to a conservative firm, which made a fortune building wooden ships there in the old days, and sentimentally attached to the place, decline to sell, even though offered several times its money value and even asked to set a price. The Maine Central yard on the north side of the iron works would also be admirably adapted to the purpose of the plant, and the works are trying to secure a strip sufficient for two or three sets of ways, but these negotiations are difficult, as the Maine Central's freight business in Bath has increased so much in the last few years that the road itself is cramped for yard room, and is as unable to extend its territory as the iron works.

While the negotiations with the railroad are pending the iron works' management is contemplating such enlargements as are practicable without more land, and as soon as the ice has come down from the upper Kennebec, work will be begun on an L pier from the north side of the plant, 150 ft. into the river and 288 ft. parallel to the present wharf, thus tripling the wharf front available for berths for vessels.

The big 100-ton crane will be moved out upon this pier, where it will be available for work on two vessels at a time. The yard space of the plant will be increased by the removal of some of the shops from the water front to the inland side of the yard, and by extending the ways into the river. Massive new ways, 535 ft. long and 35 ft. above the ground at the inland end, will be built for the battleships, and a large electric cantilever crane of the type in use at the yard of the Newport News company and that of the Cramps in Philadelphia, will replace the trolley system in use in the yard. In the future, when a suitable site can be secured, the iron works intend to build a large dry dock for the extensive repair work which could be had if the facilities were at hand. At present, for this sort of work, the works depend upon an old-fashioned marine railway.

The Portland people, taking advantage of the difficulty the iron works is having in securing territory in Bath, are making every effort to induce the concern to establish a branch on Portland harbor, instead of enlarging the Bath plant. The Portland board of trade has offered to give the concern the plant formerly occupied by the Lowell Arms Co. in South Portland, and to build a large dry dock and rent it to the iron works at a nominal figure, but the shallow water of Portland's inner harbor is a serious obstacle and the Hydes, besides, want their plant all in one place. The Bath board of trade, recently reorganized, will probably consider the situation and see what can be done to assist the Hydes in securing the land they need so much.

ITEMS OF GENERAL INTEREST.

A lodge of the American Association of Masters and Pilots was organized at Marine City Tuesday night. Twenty-seven members joined and Capt. Edward Allum was elected captain.

It is quite likely that President McKinley, who leaves for San Francisco to attend the launching of the battleship Ohio in May, will return to Washington by way of Duluth. This will include a lake trip to Cleveland or Buffalo.

A quarter of a century ago the whole of the mercantile marine of Japan could have been described on a small sheet of note paper, but now it requires a considerable volume, as it totals 491 steamers of 484,853 tons, and 1,031 sailing ships of 146,088 tons—in all 680,942 tons. Japan is now tenth on the world's list of ship owning nations.

The old oyster gunboat Chesapeake, which has been doing duty off the coast of Virginia for several years, has been placed out of commission—cause, boiler out of kilter and steamboat inspection department refuses to renew papers unless the boiler is replaced. It is likely that a new vessel will be constructed at the Wm. R. Trigg Co.'s yards at Richmond, Va.

At the annual meeting of the National Steel Co., held at East Orange, N. J., Tuesday, Henry Wick was elected president to succeed Wm. E. Reis. It was reported while negotiations for the sale of the National to the United States Steel Corporation were under way that the Moores ignored Mr. Reis entirely in their dealings with J. Pierpont Morgan. Mr. Wick will continue as chairman of the executive committee of National Steel. Other officers are: First vice-president, W. T. Graham; second vice-president, F. S. Wheeler; secretary and auditor, W. H. Baldwin; assistant secretary and treasurer, H. B. Wheeler.

Through the secretary of state the navy department has received two life-saving medals, with diplomas, awarded by the president of France to Coxswain Hugh Patrick Mullen and Seaman Paul Ausseresses of the United States battleship Kentucky for their heroism in rescuing five French seamen at Algiers on Nov. 11 last. The French sailors were thrown into the water by the capsizing of their boat and were drowning when Mullen and Ausseresses jumped from the Kentucky and saved them. Under a recent decision of the United States supreme court it will not be necessary to get the consent of congress to the acceptance of the medals by the two men.

The Shipping World year book is just from the press, compiled by Major Jones of the Shipping World, London. The enlarged new map shows the routes of steamers and railways throughout the world, with the eastbound and westbound lanes across the Atlantic, and the products, ports, coaling stations, coal fields, etc., of all countries and colonies. The book contains the tariffs of all nations and of the colonies, a complete port and harbor directory of the British Isles and a directory of all the principal ports of the world, arranged in alphabetical order, giving the particulars gathered from official sources of the accommodations, charges, tides, trades, pilotage and towage. The book is crowded with useful maritime information.

EARLY COPPER DAYS OF LAKE SUPERIOR.

MR. GRAHAM POPE RECOUNTS A DEAL OF FASCINATING HISTORY OF THE GREAT COPPER REGION—HE DISCREDITS THE ANCIENT RACE THEORY.

At the seventh annual meeting of the Lake Superior Mining Institute, which was held at Houghton, Mich., recently, Mr. Graham Pope read a paper upon the "Early Copper Days of Lake Superior." The paper contains a great deal of interesting information. Mr. Pope does not agree with his contemporaries regarding the evidences of ancient mining in the peninsula. He thinks that the workings are not particularly ancient and were made by the Indians. However that may be there were no Indians in the peninsula when copper was discovered who knew anything at all about the workings. The text of Mr. Pope's paper is as follows:

In the year 1845 the lands of the Portage lake district of Lake Superior, having been surveyed, were made subject to purchase, and for three years, during the season of navigation, men of all sorts and conditions were to be found within its boundaries hopefully prospecting for copper-bearing fissure veins, returning to their homes on the approach of winter. These eager explorers having soon found that an extraordinary amount of digging had been carried on from one end of the county to the other, and finding that the pits and trenches were comparatively modern, containing, too, a vast number of stone hammers and occasional pieces of float copper with fragments of barrel work, were at a loss to know by whom the work was done, and why it was abandoned. To us, the explanation is simple enough if we dismiss from our minds the troublesome old theory of an ancient race coming from a far distant southern land and spending only the season of navigation here. When the Europeans made their appearance on this continent, they brought with them cooking utensils made out of copper, hatchets, knives and axes made of steel, and all kinds of attractive ornaments for the person. The native Indian found it easy to obtain all these things in exchange for the skins of wild animals then so plentiful. He found them vastly superior to any he could make from copper which he could obtain only in the form of float, or of small pieces broken from the rough edges of masses. He therefore had no longer the need of hidden copper which was only obtainable by means of hard labor, always distasteful to him, and so his mining operations were abandoned forever. Two hundred and fifty years and more had passed after the red man had discontinued his work before the white man took it upon himself. There was then ample time for these pits and trenches to assume the appearance and condition in which they were found in 1845. There was no sign of any work done in the past other than that which could have been done by our modern Indian.

NO RECORD OF ANY WINTER WORK.

We have no record of any winter work in this district during the three years mentioned, except that a party of four men camped during the winter of 1846-7 near Whealkate mountain, and another party of perhaps fifteen men were engaged in actual mining in the neighborhood of Trap Rock river during the same winter, neither party knowing of the presence of the other. Three of the members of the larger party became famous in connection with this district—John R. Grout, Columbus C. Douglass and John H. Forster. The latter gentleman has left on record an expression of his feelings of desolation during that dreary winter. It was no doubt emphasized because of his failure to find copper in paying quantity. For seven months this party lived without communication with the outside world. They drifted an adit under Douglass Houghton falls and opened the surface of the rocks in many places on sections 19 and 20, township 56, range 32, without satisfactory results. Though considerable copper was found on these sections, the conditions were so disheartening that the enterprise was abandoned on the opening of navigation.

In 1847 Ransom Sheldon established a store business at Portage entry, and the steamers Napoleon and Independence occasionally anchored off the mouth of the river, there being not sufficient water to allow them to pass over the bar at the entrance. Before this season people bound for Portage lake landed at Eagle river or Copper harbor, thence coasted the shore of Lake Superior in Mackinaw boats until they reached the Portage some twenty miles west of Eagle river. A tramp of a mile and a half over the sand dunes brought them to Lily pond, which empties into Portage lake, eight miles above the camps of the explorers. Previous to this time there had been a large Indian village at Pilgrim river and another at Portage entry. These Indians, with the great number of coming and going explorers, enabled Mr. Sheldon to do a thriving business. A great deal of his time, however, was spent in studying the geological features of the district, and as fast as he acquired money and credit they were afterwards used to buy lands which afterwards became very valuable. During these three years mentioned, the mineral range for twenty miles each way from Portage lake was pretty well explored, so far as it could be done by individual effort, but as no copper had been found the approach of the winter of 1848-49 saw the district nearly deserted, and many of these people found their way to the gold fields of California. Those who remained worked on in hopes that the discovery of a rich deposit of copper would result in the organization of large capital, from which they would reap a rich reward.

THE BEGINNING OF SYSTEMATIC MINING WORK.

A small party was at work on the hillside back of the present village of Hancock during the summers of 1847 and 1848, on section 26, township 55, range 34, owned by James A. Hicks. In October, 1848, the Quincy Mining Co., having been chartered by special act of the legislature, and having bought section 26, began, under the superintendence of C. C. Douglass, regular and systematic mining work by means of shafts and drifts, which was continued for many years without any satisfactory results. During this time indications of copper in quantity were sometimes found, filling the hearts of the people with hope, and in the year 1851 the prospects were so encouraging that Mr. Sheldon moved his store business from Portage entry to the Quincy mine. These prospects ceased to be encouraging, and the store was again moved in 1853, this time to Houghton, where it found an abiding place. In the autumn of

1851, Walter W. Palmer, beginning at a point about two miles west of where Houghton village is now, cut a road four miles long through the forest to Whealkate mountain, and on the southeast quarter of section 17, township 54, range 34, established the Whealkate Mining Co., the stockholders being New York people who were then interested in the Albion mine, in what is now Keweenaw county. Mr. Palmer's first work was sinking a sand shaft, which he was forced to abandon because of the abundance of water. He afterwards sunk a shaft in the rock and hoped by drifting to strike a fissure vein.

The provisions and supplies for this party were landed at Portage entry, brought to Whealkate landing in Mackinaw boats, and thence packed through to the location. During the winter Mr. Palmer, having run short of some kinds of supplies, sent a man named McGee to the Quincy mine to get what was needed. McGee broke through the ice while crossing Portage lake and was drowned. This being the first death among the white people, the event caused much excitement and sorrow. In December, 1852, Mr. Palmer was succeeded by Capt. Joseph Pryor, who continued the work until May, 1853, when it was permanently closed, after eighteen months hard labor, during which no copper was found. In the absence of a banking system, Capt. Pryor paid his men with orders on Capt. Edwards, who in turn paid them with orders on John Senter, then engaged in business in Eagle river. When a workman wanted money he could easily get it from Mr. Senter after walking twenty-five miles through the forest with his order. Mr. Senter never told these men to come some other day. Capt. Pryor at one time gave the writer a statement of the work done at this mine by Mr. Palmer and himself. They sunk a vertical shaft in the rock to a depth of 40 ft., drifted south 20 ft., sunk at the head of the drift an incline shaft to a depth of 50 ft. From the bottom of this shaft they drove a crosscut west 100 ft., where they found a seam of laumontite. They drifted south on this seam 50 ft., and from the head of this they sunk a winze to a depth of 40 ft. Windlasses and buckets were used for hoisting and they must have filled and dumped the rock four times, wheeling it twice, a total of 170 ft., before it reached the surface dump.

From 1848 to 1852, with the exception of the men at the Quincy and Whealkate, the district was practically depopulated, although there were always a few men digging here and there, hoping to happen on a valuable deposit. Owing to the exertions of Sheldon and Douglass, who, by the way, were then and always afterwards partners in business, and who had come to have great confidence in the lodes of the district, having lost faith in the fissure veins, notwithstanding the theories of imported miners and geologists, the attention of capitalists was attracted to this place in 1852, when the Isle Royale amygdaloid lode was discovered.

The Isle Royale Mining Co. acquired the north half of section 1, township 54, range 34, for the purpose of mining this lode, and the work was vigorously prosecuted with great success in finding heavy copper. This mine was in charge of Mr. Douglass, who had become by this time one of the best posted men in the upper peninsula, having given much attention to the mining work at Keweenaw and Ontonagon which had by this time become important. He was at last successful in finding native copper in quantity in a lode or bed, and immediately began regular operations by sinking two shafts. When winter closed in he found himself short of miners, and he was obliged to go to Ontonagon and Eagle river on snowshoes to procure them. In this year the Cacique Mining Co. was organized to explore the south-east quarter of section 36, township 55, range 34.

BOOM RESULTING FROM THE SPREAD OF THE ISLE ROYALE FAME.

In the spring of 1853 the fame of the Isle Royale lode was spread abroad, not only in the United States, but also in Europe, and a great boom was on. The Portage lode was found 200 ft. west of the Isle Royale lode, and the Portage Mining Co. was organized to work both lodes at the south-east quarter of section 36, township 55, range 34, under charge of Mr. Douglass. Three shafts were sunk and the hoisting was done with horse whips and whips. The lodes where opened were well charged with copper. At the Isle Royale mine a two-flue boiler with a horizontal engine of 12 H.P. was installed, being the first steam power used in this district. When the whistle was blown during the forenoon for the first time all the men quit work for the day and indulged in a festal observance of the occasion. At this mine a large dining room with a kitchen was built of logs, in which the men were never allowed, except for meals. The log houses were built for sleeping and living rooms, one being occupied by the Americans and Englishmen, and the other by French-Canadians and Irishmen. Bunks in tiers were built around the walls, and each bunk was supplied with three heavy Mackinaw blankets. This became the practice at all the mines until many families came in.

During the year 1853 operations were begun by the Montezuma Mining Co. on the east quarter of section 35, township 55, range 34. Capt. Edwards was in charge of this mine, and opened an epidote-amygdaloid lode in which copper was found, but not in paying quantity. In May, 1853, the Albion Mining Co., taking its name from the then idle mine at Gratiot river, was organized to mine the Portage lode on the south-east quarter of section 36, township 55, range 34, which land was purchased from the Cacique Mining Co., before referred to. Capt. Edwards was the agent and opened with an adit and three shafts, one of which was rich in copper, carrying a great deal of nugget silver, because of which it was called the silver shaft. The hoisting was done at one shaft with a whip and at the others with a horse whim.

Later in the same season the Sheldon Mining Co. was organized to mine the Portage lode, on lots 3 and 4, section 36, township 55, range 34, and was owned and worked by Sheldon and Douglass. Two shafts were sunk and an adit was driven under the sidehill. The hoisting was done with horse whips. In one of the shafts considerable copper was found.

In the autumn of 1853 the Huron Mining Co. was organized with Boston capital to work the Isle Royale lode on the east half of section 2, township 54, range 34. The lode was not found until February, 1854. Three shafts were then started and all showed rich ground. This was a cause of great rejoicing, because it was the first investment of large capital in copper mining here. From one shaft 6x8 ft. in size there was taken out in the first 10 ft. three tons of mass and barrel work, and all the rock hoisted was very rich in stamp copper. J. B. Bennett was the agent of the mine, and he was also agent of the Ripley Mining Co., which owned lots 1, 2 and 3 of section 31, and the south half of south-west quarter of section 30, township 55, range 33, on the north side of the lake,

where it was supposed the Isle Royale and Portage lodes would be found, but nothing of value was discovered.

OTHER COMPANIES ORGANIZED.

The Dodge Mining Co. was organized in 1854 to mine the Isle Royale lode on the north-west quarter of section 11, township 54, range 34. Two shafts were sunk on a hungry looking amygdaloid lode without mineral. They never found the Isle Royale or Portage lodes. They are probably 1,000 ft. farther west. From the Huron mine on the south to the Ripley mine on the north, everywhere on the line of these lodes were found the Indian pits referred to, being particularly numerous on the Ripley location, where great quantities of stone hammers were stored, brought from the shores of the lake outside of Portage river. At the Portage mine on the Isle Royale lode a large pit was found where the Indians had worked down on the hanging side of the lode 10 ft. below the surface of the rock. At the bottom of this pit was a floor of mass copper into which they could not penetrate. The pit marks show that the work was done with the help of fire.

During the summer of 1853 the Pewabic Mining Co. was organized and bought the west half of section 25, township 55, range 34. Following the example of the Quincy company their work was confined for a long time to the sidehills and ravines facing the lake. The success of the mines on the south side of the lake promised a permanent future for this industry and during the year 1853 a great many miners from Cornwall, Ireland and Germany came into the place, many of them bringing families. Because of this the village of Houghton was platted and lots were sold on easy terms to builders. The whole of the present county of Houghton was organized into the one township of Portage, and on Oct. 10, 1853, a special first election was held, when C. C. Douglass was elected supervisor, the whole number of votes cast being 28. There being no opposition, but little interest was taken in the voting.

In April, 1854, the regular spring election was held, two tickets were put in the field and there was a most exciting contest for the offices. All mining work was stopped on election day and so greatly had the population increased that 135 votes were cast, of which Richard Edwards received 63 and C. C. Douglass 72, the latter being elected supervisor. The voters from the north side of the lake spent the day in Houghton, and considerable friction was manifest among the different nationalities, growing from the fact that a great many men were prevented from voting by the challengers who required proof of citizenship. This was sometimes referred to as the "Nose Bleed" election.

FIRST USE OF STEAM POWER.

In the spring of 1854 the Huron Mining Co. decided to use steam power at one shaft and a purchase was made of a locomotive boiler with engine and drum attached. Capt. Bennett made up his mind that that plant should go up the hill by means of its own power. The people assembled in great numbers to see the work. They got the plant up to the mine, a mile and a half, in ten days. In the spring of 1854 the Isle Royale company began building a stamp mill, and in October the mill was pounding rock. In November, 1854, this company made its first shipment of Portage lake copper. It was loaded on a scow which was poled along the shore and reached Portage entry after a toilsome journey of twenty-four hours. The copper was there transferred to the steamer Napoleon for shipment to Pittsburg for smelting. The rock for this mill was roasted in kilns and when the wood was all burned water was thrown on to crack the rock, which was then broken small enough for the stamps with hand hammers, then hauled to the mill in wagons. The stamping machinery consisted of sixteen heads of Cornish stamps with a large cast-iron axle, into which were driven wooden cams. The number of stamps was soon increased to twenty-four heads, and the capacity of the mill raised to a maximum of thirty-six tons in twenty-four hours. Owing to breakdowns so much time was lost that the best month's record in its history was 800 tons in twenty-six days. T. A. Trevathan, who worked in the first stope in the mine, was put in charge of the mill.

During the year 1854 the Albion Mining Co. built a stamp mill with sixteen heads before they had much ground opened. The result was the stopping of the mine and the forced sale of the mill machinery. The boilers for this mill were hauled around the rapids at the Sault and loaded on a steamer for Portage entry. No lighters were to be had and the boilers made two or three voyages. Finally under the charge of J. B. Lyons, late a member of this institute, all the openings being plugged, the boilers were launched overboard. One of them came back at the steamer and knocked a big hole in her side, but fortunately, above the water line. The boilers were well roped together, the domes being kept upright by means of heavy planks bolted across them. A large sail was hoisted and the boiler catamaran sailed into the river. A large Mackinaw sail boat was then chartered to go ahead with a long cable and the whole outfit sailed up Portage lake fifteen miles to Houghton, where the boilers were pulled ashore by cattle power. The engine in the Albion mill was thought to be near perfection. It was a beam engine 32 in. diameter of cylinder with 72 in. stroke. It was used for twenty years afterwards by the Isle Royale Co., when it was destroyed by fire.

In 1855 the Portage Mining Co. built a stamp mill in Houghton village, hauling the rock to the mill in wagons after it had been prepared as above mentioned. The mill had sixteen heads of Cornish stamps and a capacity of 24 tons a day when in good order. In both the Portage and Isle Royale mills only selected rock was stamped and the cost of stamping was from \$2.50 to \$3 per ton. A great deal of copper was lost owing to the crude form of washing then in vogue. During the season of 1854 a great many people came into the country, but there was not work for all of them. All this time the Albion mine was closed and its discharged employees increased the force of idle men.

THE PANIC OF 1855.

In January, 1855, orders came to all the companies to reduce expenses and a panic was on. The boarding house people could not afford to board idle men until spring without payment, and so some 400 men started through the forest for Green Bay which at that time was the nearest large settlement. The weather was very cold, the snow was very deep, and the travelers were without snowshoes. The sufferings of these men were terrible. With frozen hands and feet and faces, they made their weary way with insufficient food. Five persons were known to have perished and some were never heard of again. In the spring a more hopeful feeling prevailed. An assessment was called by the Isle Royale Co. and

W. E. Dickenson became agent. A tram road was built from the mine to the mill, one and three-quarters miles long, including sidings. The loaded cars, holding two tons each, were hauled to the head of the incline by horses. This incline was so flat that a yoke of cattle was used to start the descending train, after which it managed to run to the mill, taking up the empty cars. The train would, however, often perversely stop half way down, when the cattle were sent after it to give it a fresh start. It was said that the new method was cheaper than the old one of wagon haulage. During this winter the work at the Quincy and Pewabic was pushed forward with shafts, adits and pits without success. Explorations on the shore lands west of Houghton by Pittsburg and Boston people were continued until winter, and a number of prospectors were at work on the highlands south of Houghton.

In 1856 after three years' effort at the Pewabic location and eight years' continuous effort at the Quincy location, the great Pewabic amygdaloid lode was uncovered by the Pewabic company, when both companies had become almost disheartened and with the treasuries empty. The lode was immediately located by the Quincy company and from that time forward the work never halted. Samuel W. Hill was put in charge of the Quincy mine and Charles H. Palmer of the Pewabic mine.

During the season of 1856 a great many Irishmen came in and found plenty of work at these new mines. In the autumn of this year there was a great row at the Minnesota mine, where a number of Cornishmen and Irishmen were injured and one killed with an ax. On receipt of the news at Portage lake all the mines stopped and some 400 Irishmen gathered on the Quincy dock prepared to march to Ontonagon through the forest for the mad purpose of killing every Cornishman. After many hours of hot discussion wiser counsels prevailed and the proposed massacre was abandoned. Messages had been sent to Ontonagon warning the people of the threatened invasion, and the steamer Illinois left that port well loaded with passengers seeking a less strenuous people. Soon after this the general election was held, when out of a total of 180 votes, in the present limits of Houghton county, John C. Fremont electors received 36, and James Buchanan electors 144.

In 1857 the Franklin Mining Co. was organized to work the Pewabic lode on the south-west quarter of section 24, township 55, range 34, under the same management as the Pewabic company. The success of these companies was so great that each decided to build a stamp mill. The Pewabic company built their mill in 1858, and the Franklin company in 1859. These two companies were the first to use the Ball stamp in this place. The stamp shaft was 6 in. in diameter, the cylinder was 9 in. with 24-in. stroke. The capacity was from 80 to 100 tons per head per day. The cost of stamping was from \$2 to \$2.25 per ton. When Mr. Ball was asked why he used spring timbers under the heads, he said: "I am building these stamps." Being of an impetuous temper, that was not all he said. The number of heads was soon increased to four in each mill, and gave great satisfaction.

The Quincy mill was begun in 1859 and completed in the spring of 1860. It was a Gates drop stamp, but so improved over the Cornish stamps in use in Houghton that each head crushed three tons per day, thus giving the mill with sixty heads a capacity of 180 tons per twenty-four hours. This mill was always stopped four weeks every winter for general repairs. The washing machinery at the Quincy was an improvement of that in use at the Houghton mills, but at the Pewabic and Franklin mills Mr. Ball introduced his rotary washers, which were a great improvement over any other methods in the way of labor saving, but exceedingly wasteful of the copper, which was a matter of great satisfaction to the men who had the tailings on tribute. In 1859 the Quincy sold to the Hancock Mining Co. part of the south-west quarter of section 26, township 55, range 34, reserving, however, the right to mine thereon the Pewabic lode. The Hancock company opened a lode to the west which gave them considerable copper. In the same year the Columbian Mining Co. bought the Albion mine which had been stopped in 1854 as above stated, and began again the development of the Portage lode.

SUCCESS OF THE PEWABIC MINE.

The great success of the Pewabic lode, which continued to be rich in copper in all the openings, attracted still further the attention of Boston capitalists and a number of mining companies were organized to work that lode to the north, namely the Mesnard, Dorchester, St. Mary and Albany and Boston. The two latter companies do not seem to have found the lode, but spent much money on an amygdaloid-epidote lode which proved worthless. Both these companies opened the Albany and Boston conglomerate, now known as the Allouez conglomerate, which often looked well in the drifts and stopes, but under the test of stamping failed to be profitable, because of the necessity of breaking out many tons to get out one for the mill. The wages paid per month previous to 1860 were about as follows: Mining captain, \$75; second captain, \$60; timbermen, \$50; helpers, \$35 to \$40; landers, \$31; wheelers and fillers, \$29; teamsters, wood choppers and surface men, \$28 to \$29; blacksmiths, \$35 to \$50; engineers, \$32; carpenters, \$31 to \$40; boss carpenter, \$51; company account miners, \$37; contract miners, \$45 to \$50. Board was \$11 to \$12 per month.

The success of the mines on the Pewabic lode being assured, the Quincy company laid out the village of Hancock, which immediately took rank with others of the peninsula. The broad and high plateau of sand and gravel had great natural advantages over the rocky hill side on which Houghton was built. During the time of this growth of the copper industry all merchandise and machinery was brought to Portage entry by steam or sail vessels, where it was transferred to lighters and towed to the docks of the mines and villages at a cost of \$4 per ton. In 1859 the producing mining companies with Sheldon and Douglass, organized the Portage River Improvement Co. and dredged out the bar and other shoal places so that in November, 1860, the steamer Illinois, drawing 10½ ft. of water, came to Houghton with 400 tons of freight on board. The work was continued the following year so that any boat able to pass the Sault locks could enter Portage lake. Previous to the opening of the river all passengers, mail, express and baggage were transported from Portage entry by light draught tugs and steamers. There were, as is usually the case, two rival lines, but which never reduced the rates.

The arrival of the first boat in the spring was an event which will never be forgotten by those who lived here in early days. A lookout was kept on Pewabic bluff and when the boat passed the Huron islands notice was given and the whole population, men and women, made for the water side. As soon as the steamer reached the dock it was taken possession of,

and no freight could be landed so long as the "trader" had remaining any eggs, fruit, vegetables, or other articles which the people had been deprived of so many winter months. The demand for newspapers was extraordinary because for a month before navigation opened no overland mail could be brought through. The steamboats of those days made the voyage in much less time than is done now, when passengers travel only for pleasure.

PRIMITIVE CONDITIONS OF LIFE.

At that time there was no railroad nearer than Green Bay, and all mail and express matter, as well as passengers came by boat. The tables were always well supplied, and the officers never wearied in making the people comfortable. Every boat had a saloon. In the day time there was much card playing and in the evening always music and dancing. In the winter the mail was brought in by dog trains and they were always uncertain. Your expected letter might come or it might be in one of the bags hung in a tree, or in one used to help out the carrier's camp fire. All the copper produced was sent to Pittsburg for smelting until the close of 1860, when the local smelter was established. The product of Lake Superior for 1860 was about 5,000 tons, and the president of one company objected to calling an assessment because he feared the over-production would make the business unprofitable before he could get his mine in shape.

Up to this time and for many years afterwards, all underground work was done with drill and hammer and black powder, pick and shovel and wheelbarrow. The hoisting was done with kibbles and buckets, with hemp rope or with chains. No mining engineer was required and the manager who could not work out any problem was not fit for his job. No company had money in its treasury, and while supplies for mining work were always scarce, none at all were to be had during the long winter. All sorts of expedients were resorted to to get things going again when breakdowns occurred and it is a wonder that so much was done, and done so well.

Before the years which are included in this paper there were no technical schools in America, except the institute in Troy, N. Y., which in those days taught nothing in mining engineering. Nevertheless there were many men of liberal education, of fine culture and of great natural ability, who sought the opportunity to take up their life work in this place. As is always the case in any pioneer district, so it was here, that men of enterprising minds, of unwearied zeal, of unflinching courage, were among the first to penetrate the wilderness. They were full of resource and accomplished great things. They were full of human kindness and never failed their neighbors in distress. They were hospitable and the stranger was ever welcome if he was a manly man. This generation is to them greatly indebted.

This little story closes with the year 1860, but it may be well for the writer to refer to a few things of later happenings which led to the great changes in mining methods in the copper region, and which otherwise may never be told. In 1864 John Mabbs became the agent of the Isle Royale mine. He was without previous experience in mining, being a machinist by trade. His mine was poor, there was no money in the treasury and the frequent assessments took care only of the floating debt, and yet his record stands out as a singular one in the introduction of saving methods. He introduced the large drum for deep hoisting by installing one of 16 ft. diameter at No. 5 shaft. He also put in a flat band hoist at No. 8 shaft, with a 16-ft. sheave, thus increasing the speed of the rising skips. This flat band idea was taken from the band Mr. Dickenson used on the gravity tramway before referred to. It was made of sections of flat steel 4 in. wide, $\frac{1}{4}$ in. thick and 30 ft. long, which were butted together, and over this joint a piece of the same steel, 6 ft. long, was carefully riveted. Whenever a break occurred the blacksmith riveted another piece on, so that it was very lasting. The depth of this shaft was 800 ft. Mr. Rand having introduced a heavy drill for tunnelling, was persuaded by Mr. Mabbs to make a light and portable one for mine use. He then made a compressor out of some old engines at the mine. Having also a lot of cast iron pipes of different sizes, he made them tight together by driving in wooden wedges at the joints, and thus successfully introduced the power drill with compressed air sending it 2,000 ft. He found in Chicago an incomplete and unworkable diamond drill which he bought and took to M. C. Bullock, who perfected it. It was used here for some time and afterwards sold to the Quincy company, and it is well known what it did for them.

FIRST USE OF NITRO-GLYCERINE.

The story of the introduction of high explosives is so interesting that I venture to give it at length. In 1870, I think it was, but possibly in 1869, Mr. Mabbs bought in New York 4,000 lbs. of the pure nitro-glycerine oil, which was contained in 100 tin cans. The oil was thirteen times stronger than the black powder then in use. About this time a number of terrible accidents occurred from the use of this oil, and a great outcry rose against it, but after much trouble he persuaded one of the Pennsylvania coal carrying roads to take it. Unfortunately news of its shipment was sent forward, when a mob assembled and stopped its passage. It was then sent back 100 miles, transferred to another road and finally reached Cleveland. Mr. Mabbs, fearing arrest for violating the city ordinances, was anxious enough to get away, but could get no steamboat to take it, and as few sailing vessels were bound for Portage lake it was only after great trouble he was able to persuade a master to take it to a powder magazine above Hancock. The Hancock authorities having heard of its presence promptly ordered it out of the place, and it was removed at night to an old stope in the mine. A few days after this orders came from the east to close the mine, and he had time only for a few blasts. Nothing disheartened he persuaded the Huron mine agent to allow its use there, with the understanding that he was to do the blasting. He put up a little magazine back of the burrows and under cover of darkness put there one can only of oil, containing 40 lbs. The miners became so excited and furious that they stopped the mine. A great mob gathered and preparations were made to ride the enterprising agent out of the place on a rail, but they did not get him. That night the mob blew up the magazine thinking all the stock was there. It having leaked out that there was more of it, searching parties were formed to get it. It was moved half a dozen times just in time to save it, and finally it was hidden in the woods just east of where the mining school now stands. Mr. Mabb and his brother had in each case handled the oil themselves. They finally loaded

it into a yawl boat, and started with it for Marquette, which place they reached in safety after a narrow escape from being lost in a storm on the lake. They got permission to try it on some of the hard heads in the iron mines and were so successful they had no trouble in closing out their stock and the use of this material was continued there to a limited extent until the present method of making it was adopted, when its use became immediately general.

WATER TUBE BOILERS IN THE BRITISH NAVY.

THE COMMITTEE APPOINTED BY THE ADMIRALTY HAS MADE ITS REPORT—IT IS UNFAVORABLE TO THE BELLEVILLE BOILER, THOUGH NOT SWEEPINGLY SO.

The committee appointed by the British admiralty to inquire into the question of water tube boilers in the British navy has submitted its interim report. It is of such a character as to provoke discussion in the engineering departments of all navies. It is doubtful if any single departure has caused as much controversy as the introduction of water tube boilers in marine engineering. The personnel of the committee, appointed to investigate the subject by the admiralty, was as follows: Vice Admiral Sir Compton Donville, chairman; Mr. J. A. Smith, inspector of machinery, royal navy; Mr. John List, superintending engineer to the Castle line; Mr. James Bain, superintending engineer to the Cunard line; Mr. J. T. Milton, chief engineer surveyor of Lloyd's Registry of Shipping; Dr. A. B. W. Kennedy; Dr. John Inglis of the firm of A. & J. Inglis, well known engineers and ship builders. The joint secretaries were Commander Montague E. Browning, royal navy, and Chief Engineer W. H. Wood, royal navy. The instructions to the committee were to report whether in its judgment water tube boilers were more suitable than cylindrical boilers for naval purposes; and if they were considered superior, whether the Belleville type was the best for vessels of the royal navy. The report is, without doubt, of great value. With the exception of Mr. J. A. Smith, who, as inspector of machinery in the navy, may be taken as representing the engineering branch, it is unanimous; and it is unfavorable to the Belleville boiler. The exception of Mr. Smith, however, is of vast importance, because he doubtless knows more about boilers than any other member of the committee.

The report is given in full below, but a few of its leading features will be noted in this introduction. To begin with, it flatly declares that "the advantages of the water tube boilers for naval purposes are so great, chiefly from the military point of view, that provided a satisfactory type of water tube boiler be adopted it would be more suitable for use in the navy than the cylindrical type of boiler." The committee, however, does not think that the Belleville boiler has any such advantages over other types of water tube boilers as to lead them to recommend it as the best adapted to the requirements of the navy. In fact, the committee recommends that Belleville boilers be not fitted to ships which are to be ordered in the future, but does not countenance any change in vessels now under construction, which have been ordered fitted with Belleville boilers. The report must, therefore, be regarded as unfavorable to the Belleville boiler, though it is by no means such wholesale condemnation as that heard from certain critics who have permitted the personal element and not the engineering merits to sway them.

A point of interest in the report is that cylindrical boilers are commended for auxiliary purposes. It is pointed out that a large proportion of the coal expended in the navy is required for distilling and auxiliary purposes in harbor as well as at sea, and it is suggested that the cylindrical boiler is more suitable for supplying steam for such uses than any type of water tube boiler. Following is the text of the report:

1. The committee are of opinion that the advantages of water tube boilers for naval purposes are so great, chiefly from the military point of view, that, provided a satisfactory type of water tube boiler be adopted, it would be more suitable for use in the navy than the cylindrical type of boiler.

2. The committee do not consider that the Belleville boiler has any such advantage over other types of water tube boilers as to lead them to recommend it as the best adapted to the requirements of the navy.

3. The committee recommend: (a) As regards ships which are to be ordered in the future: That Belleville boilers be not fitted in any case. (b) As regards ships recently ordered, for which the work done on the boilers is not too far advanced: That Belleville boilers be not fitted. (c) As regards ships under construction, for which the work is so far advanced that any alteration of type of boiler would delay the completion of the ships: That Belleville boilers be retained. (d) As regards completed ships: That Belleville boilers be retained as fitted.

4. In addition to the Belleville type of boiler, the committee have had under consideration four types of large straight tube boilers which have been tried in war vessels, and are now being adopted on an extended scale in foreign navies. These are: (a) The Babcock & Wilcox boiler; (b) the Niclausse boiler; (c) the Durr boiler; (d) the Yarrow large tube boiler. (a) and (b) have also been tried in our own navy with satisfactory results, and are now being adopted on a limited scale. If a type of water tube boiler has to be decided on at once for use in the navy, the committee suggest that some or all of these types be taken.

5. The committee recommend that the completion of the two sloops and the second-class cruiser fitting with Babcock & Wilcox boilers, and the sloop and first-class cruiser fitting with Niclausse boilers, be expedited, in order that the value of these types of boilers for naval purposes may be ascertained at the earliest possible date. This is especially important, as the Babcock & Wilcox boiler adopted in the ships under construction differs materially from the Babcock & Wilcox boiler as fitted in the Sheldrake.

6. The committee recommend that boilers of the Durr and of a modified Yarrow type be made and tested at the earliest possible date, under their supervision, with a view of aiding the selection of one or more types of water tube boilers for use in ships of the navy. For this purpose the committee suggest that two cruisers, not smaller than the Medea class, with vertical triple expansion engines, be placed at their disposal, and that they be empowered to order at once Durr and Yarrow boilers to be fitted to them, and to order also the removal of their present boilers and the necessary modifications to their machinery, so that the performance of the

types of boilers named may be definitely ascertained under ordinary working conditions from extended seagoing trials. The committee suggest vessels not smaller than the Medea class, because the evidence before them shows that it has been difficult to draw from torpedo gunboat trials conclusions fully applicable to larger vessels.

7. With reference to paragraph 1, evidence has been given before the committee to the effect that three most important requirements from the military point of view are: (a) Rapidity of raising steam and of increasing the number of boilers at work. (b) Reduction to a minimum of danger to the ship from damage to boilers from shot or shell. (c) Possibility of removing damaged boilers and replacing them by new boilers in a very short time and without opening up the decks or removing fixtures of the hull. These requirements are met by the water tube boiler in a greater degree than by the cylindrical boiler, and are considered by the committee of such importance as to outweigh the advantages of the latter type in economy of fuel and cost of upkeep.

8. The opinion expressed by the committee in paragraph 2 has been formed after a personal examination of the boilers in a number of his majesty's ships, including the Diadem, Niobe, Europa, Hermes, Powerful, Furious, and Ariadne; upon the statements of defects which have been placed before them; and the evidence of the chief engineers of those vessels and other officers on the engineering staff of the admiralty and dock yards. This evidence is being printed, and will be forwarded when ready.

9. The committee consider the following points in relation to the construction and working of the Belleville boiler to constitute practical objections of a serious nature: (a) The circulation of water is defective and uncertain, because of the resistance offered by the great length of tube between the feed and steam collectors, the friction of the junction boxes and the small holes in the nipples between the feed collector and the generator tubes, which also are liable to be obstructed, and may thus become a source of danger. (b) The necessity of an automatic feeding apparatus of a delicate and complicated kind. (c) The great excess of the pressure required in the feed pipes and pumps over the boiler pressure. (d) The considerable necessary excess of boiler pressure over the working pressure at the engines. (e) The water gauges not indicating with certainty the amount of water in the boiler. This has led to serious accidents. (f) The quantity of water which the boiler contains at different rates of combustion varying, although the same level may be shown on the water gauges. (g) The necessity of providing separators with automatic blow-out valves on the main steam pipes to provide for water thrown out of the boilers when speed is suddenly increased. (h) The constant trouble and loss of water resulting from the nickel sleeve joints connecting the elements to the feed collectors. (i) The liability of the upper generator tubes to fail by pitting or corrosion, and, in economizer boilers, the still greater liability of the economizer tubes to fail from the same cause. Further: (k) The upkeep of the Belleville boiler has so far proved to be more costly than that of cylindrical boilers; in the opinion of the committee this excess is likely to increase materially with the age of the boilers. (l) The additional evaporating plant required with Belleville boilers and their greater coal consumption on ordinary service as compared with cylindrical boilers, has hitherto nullified to a great extent the saving of weight effected by their adoption, and, in considering the radius of action, it is doubtful whether any real advantage has been gained. The committee are not prepared without further experience to say 'to what extent this may not apply to other types of water tube boilers.

10. At the time the Belleville boiler was introduced into the navy in the Powerful and Terrible, it was the only large tube type of water tube boiler which had been tried at sea on a considerable scale under ordinary working conditions. The committee therefore consider that there was justification for then regarding it as the most suitable type of water tube boiler for the navy.

11. To obtain satisfactory results in the working of the Belleville boiler, in face of the defects named in paragraph 9, more than ordinary experience and skill are required on the part of the engine room staff. It appears, however, from the evidence placed before the committee, that the engineer officers in charge of Belleville boilers have not been made acquainted with the best method of working the boilers, and that which experience has shown to be most effectual in preventing the pitting and corrosion of tubes.

12. In view of the rapid deterioration of economizer tubes in several vessels, the committee have specially considered whether the extra power per ton of boiler at high rates of combustion, obtained by the use of economizers, has not been too dearly purchased. The evidence before them indicates that at the lower and more usual rates of combustion the Powerful type of boiler has given results as satisfactory as the economizer type. It is at the same time less complex, and free from the special risks of tube deterioration which have proved so serious in many cases, notably in the Europa. They therefore recommend, for ships under construction, that the non-economizer type should be reverted to where practicable, with the tubes raised higher above the fire bars to increase the combustion space, and that where possible the steam collectors should be made larger and more accessible internally.

13. The evidence before the committee shows that a large proportion of the coal expended in the navy is used for distilling and other auxiliary purposes, in harbor as well as at sea. For such purposes the cylindrical boiler is, in the opinion of the committee, more suitable and economical than any type of water tube boiler. They recognize that there are objections to fitting cylindrical and water tube boilers in combination, but they believe that those drawbacks would be more than compensated for by resulting advantages, observing that the cylindrical boilers could be used for supplying distilled water in case of failure or insufficiency of the evaporating plant. On these grounds it is considered desirable that all the new vessels of large power should be provided with cylindrical boilers to do the auxiliary work.

14. The committee have to state that a series of comparative trials for determining economy in coal and water consumption were arranged in October, 1900, for H. M. S. Minerva and Hyacinth. The trials of the former ship commenced on Jan. 7, as soon as she was ready, but were temporarily interrupted by recent events. The committee are, however, now informed that the Minerva will not be again available until after March 2, and that the Hyacinth will not be ready to commence her trials until the first week in April. It is proposed to include in these trials a full speed run for both ships from Portsmouth to Gibraltar and back.

The foregoing report is signed by all members of the committee excepting Mr. Jos. A. Smith, who says:

"I concur with the above report, except as regards paragraph 3, and on the point dealt with in that paragraph my report is as follows:

"1. Although the Belleville boiler has certain undesirable features, I am satisfied, from considerable personal experience, and from the evidence of engineer officers who have had charge of boilers of this type in commissioned ships, that it is a good steam generator, which will give satisfactory results when it is kept in good order and worked with the required care and skill. I am also satisfied, from my inspection of the boilers of the Messageries Maritimes Co. steamer Laos, after the vessel had been employed on regular mail service between Marseilles and Yokohama for more than three years without having been once laid up for repairs, that with proper precaution, the excessive corrosive decay of the tubes which has occurred in some instances can be effectually guarded against.

"2. Having in view the extent to which Belleville boilers have already been adopted for ships of the navy, and the fact that there are now three or four other types of water tube boilers which promise at least equally good results, I am of opinion that, pending the issue of the final report of the committee, Belleville boilers should not be included in future designs. At the same time I see no necessity for delaying the progress of ships which have been designed for Belleville boilers in order to substitute another type of boiler."

GREATER EFFICIENCY, NO SMOKE OR DIRT, LESS FUEL.

Owners of some of the finest steam yachts of New York, as well as the management of the White Star line, Mallory & Co., Neafie & Levy and the Delaware River Navigation Co. of Philadelphia, are taking up a system of fuel economizing, smokeless furnaces introduced by the Steam Boiler Equipment Co. of 20 West Houston street, New York. The apparatus, which is known by the name "Hydro-Carbon System," seems to have first found favor in the Astor yacht Nourmahal, and now the company is equipping such well-known yachts as Howard Gould's Niagara, the Aloha, owned by Arthur Curtis James of New York, Isaac Stern's Virginia, Allison V. Armour's Utowana, and the Margaret, owned by Isaac E. Emerson of Baltimore. Numerous tests of the system, conducted with regard for all the data that would be required from the standpoint of engineering accuracy, have been made and the results in printed form will be furnished upon application to the company's New York office. The captain and engineer of the Nourmahal have published this statement:

"After using the Steam Boiler Equipment Co.'s apparatus on our eight furnaces for a full season under all conditions of service, it was accepted in less than the thirty days allowed for test and trial by the contract—entirely on its merits as a fuel saver, smoke, soot and cinder preventer. We are pleased to report a saving of over 25 per cent. in fuel with increased power. Since putting in this apparatus we have found that we no longer need our two 48-in. blower fans, formerly used for forced draft, as the new appliance produced the required increase of pressure much quicker and holds it better—and this at a saving in steam. We are now taking out our blower fans to utilize the space for other purposes." Mr. H. C. Farnham, chief engineer of the Nourmahal, adds: "I consider the Steam Boiler Equipment Co.'s apparatus one of the greatest improvements ever made to any steam plant under my charge."

A circular dealing with the system makes these claims: There is a steady induced draft, regardless of the atmospheric conditions, or the size or height of chimney. The system is positive, instantaneous, yet flexible in its action; is simple in construction, repairs being easily and quickly made. The smoke, soot and cinder nuisances are abated, leaving the tubes or flues free from soot. Low grades of fuel are successfully burned and there is less refuse, due to the more perfect combustion of the materials. This is accomplished by the introduction of a certain amount of hydrogen gas with a chemically correct amount of oxygen, which, holding in check the carbon and gases liberated from the fuel, gives complete combustion. This, it is claimed, not only prevents the formation of smoke and soot, or emission of noxious gases, but utilizes all the heat producing qualities of the coal or fuel, and passing it through clean flues effects a substantial saving in fuel.

"Installations are made," says an announcement from the company, "with a guarantee to save fuel, increase boiler capacity and efficiency, give any desired draft, and to prevent smoke, soot and cinder nuisances, thus demonstrating on a person's own plant exactly what we can accomplish, without disturbing them in their work. The system has been successfully applied to high pressure boilers of the horizontal tubular, water tube and upright types, and to marine and locomotive boilers. If you have a steam plant, in factory, power house, steam yacht, steamship, or locomotives, on application to this office, an expert examiner will make an inspection, and submit a proposition."

A chart of Agate and Burlington bays (Two Harbors) has just been issued and may be had from the Marine Review at 20 cents. As the district covered is small, the chart is on a large scale and shows clearly all the docks at Two Harbors. It is valuable also as a chart covering a part of the north shore of Lake Superior that is most visited by the ore and coal carriers.

VALUE OF STOCKS—LEADING IRON AND STEEL INDUSTRIALS.

Quotations furnished by HERBERT WRIGHT & Co., Cleveland,
Date of March 27, 1901.

NAME OF STOCK.	OPEN	HIGH	LOW	CLOSE
American Steel & Wire.....	42½	43¼	42	43½
American Steel & Wire, Pfd.....	107	107½	107	107½
Federal Steel	48¼	48¾	48¼	48¾
Federal Steel, Pfd.....	101½	101¾	101	101¾
National Steel	52	52½	52	52½
National Steel, Pfd.....	113½	113½
American Tin Plate	70	70½	70	70½
American Tin Plate, Pfd.....	115½	115¾	115½	115¾
American Steel Hoop.....	41½	42½	41½	42¼
American Steel Hoop, Pfd.....	92¼	92½	92¼	92½
Republic Iron & Steel	16¾	17½	16½	17½
Republic Iron & Steel, Pfd	68¾	69½	68½	69½

INTERESTING COMPRESSOR PLANT.

The compressor shown in Fig. 1 was recently installed in S. Freeman & Sons' plant at Racine, Wis., and which has a capacity of 300 cu. ft. of free air per minute, is 10-in. base and 42-in. stroke. This compressor furnishes air for operating pneumatic tools and also a three-ton pneumatic elevator. It was built by the Sedgwick-Fisher Co. of 53-55 South Clinton street, Chicago. It is designed to be attached tandem fashion to a steam engine, or it may be operated by belt power.

In attaching the compressor tandem, the back cylinder head of the engine is fitted with a stuffing box to receive the piston rod of the com-

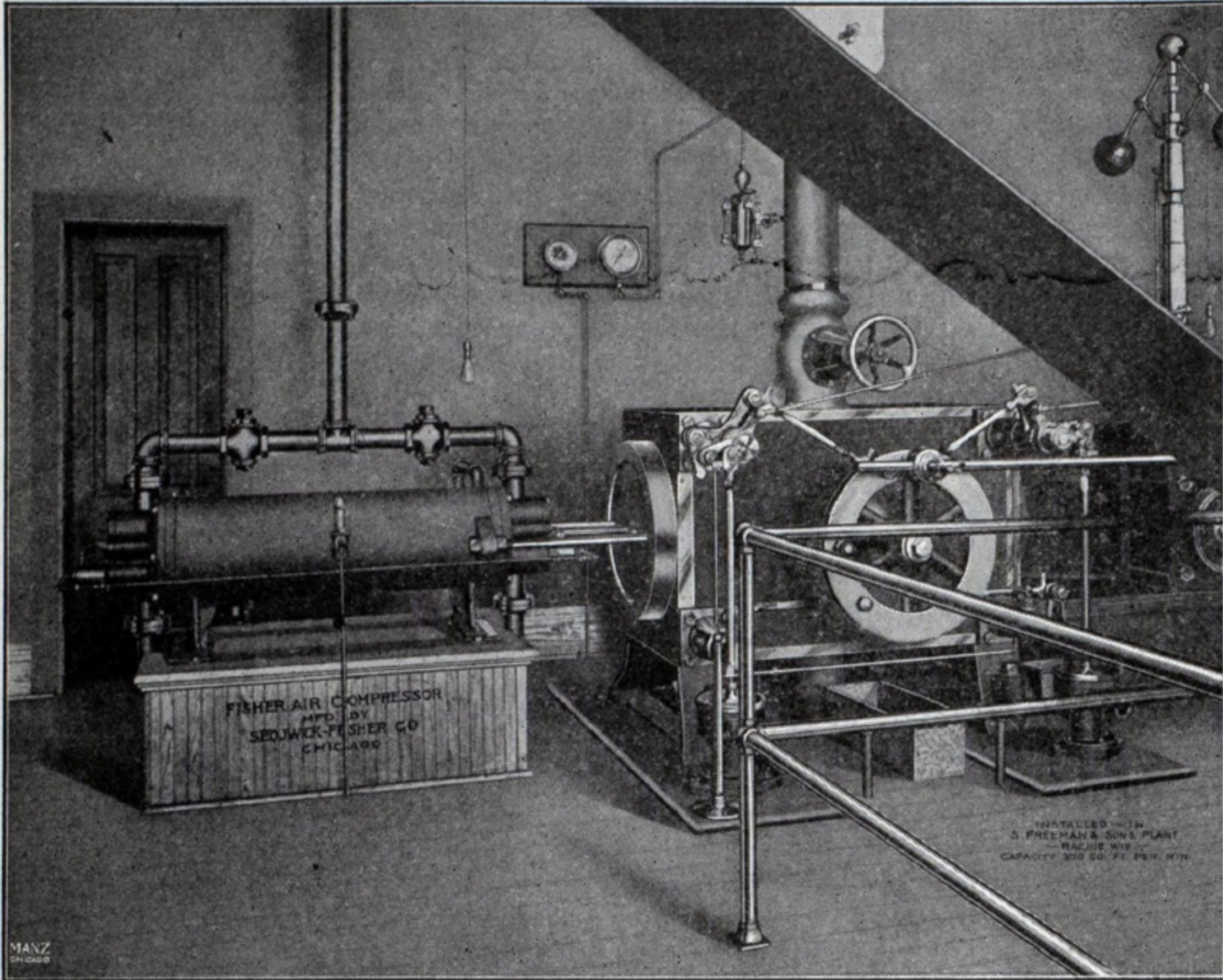


Fig. 1. Compressor Plant.

pressor and the head is drilled and tapped to attach the two tie rods which hold it firmly in position. The piston rod of the compressor is screwed into the piston of the engine operating in unison and in a direct line. Further, any of the valves may be removed while the compressor is in motion without losing any of the air compressed. This is of decided advantage in case of a slight accident to the most vital parts of any com-

pressor. The receiver pressure is automatically regulated to any desired pressure, which will be maintained, within two pounds, up to the capacity of the machine. No air is compressed unless the receiver pressure falls below the point set on the regulator, the result being a saving in fuel.

The capacity of the compressor can be increased or decreased by a simple change in the diameter of the inner cylinder and piston. For instance, if the bore is 5 in. in diameter and the stroke 18 in., the capacity may be increased by removing the 5-in. cylinder and substituting one that

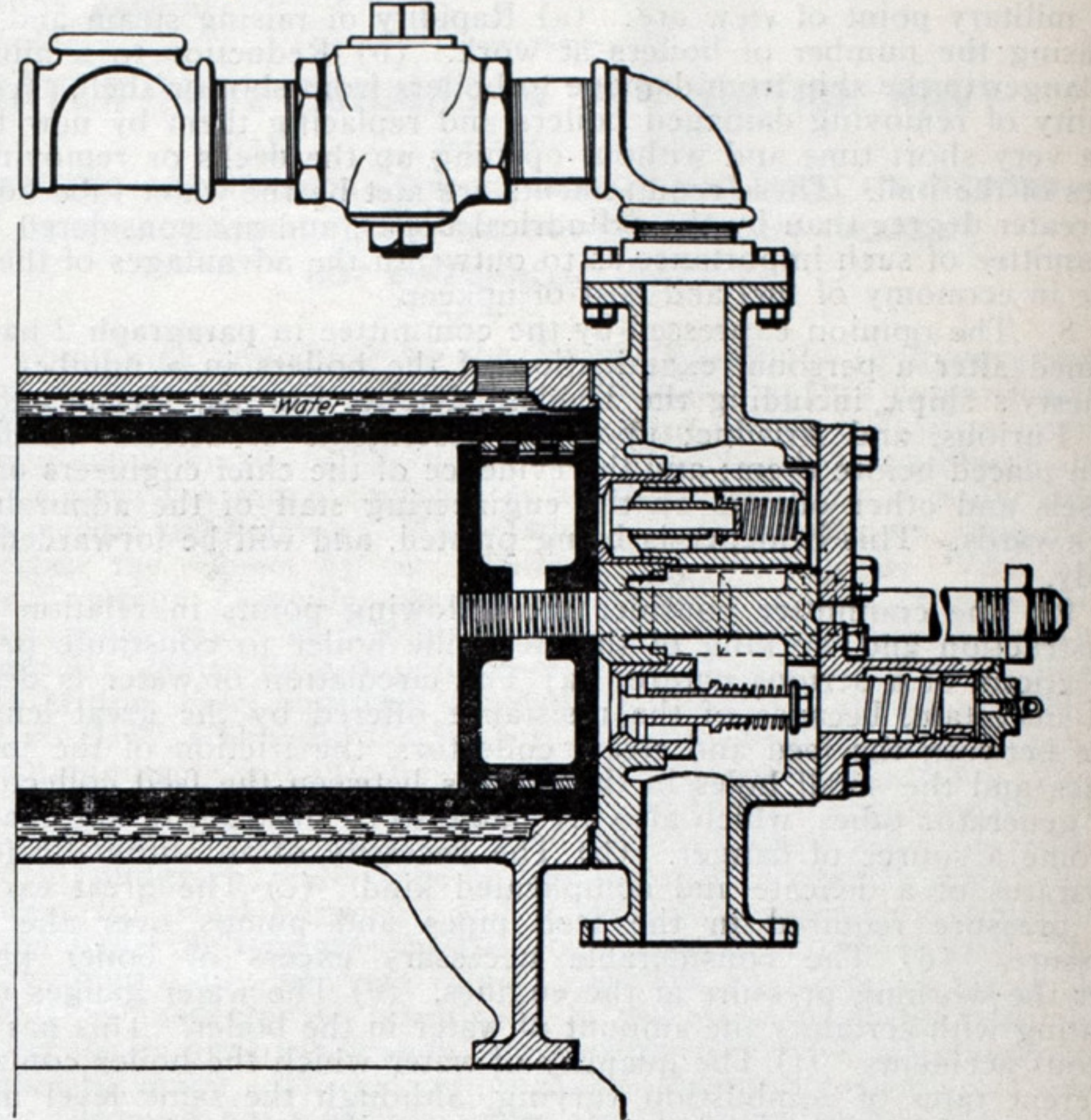
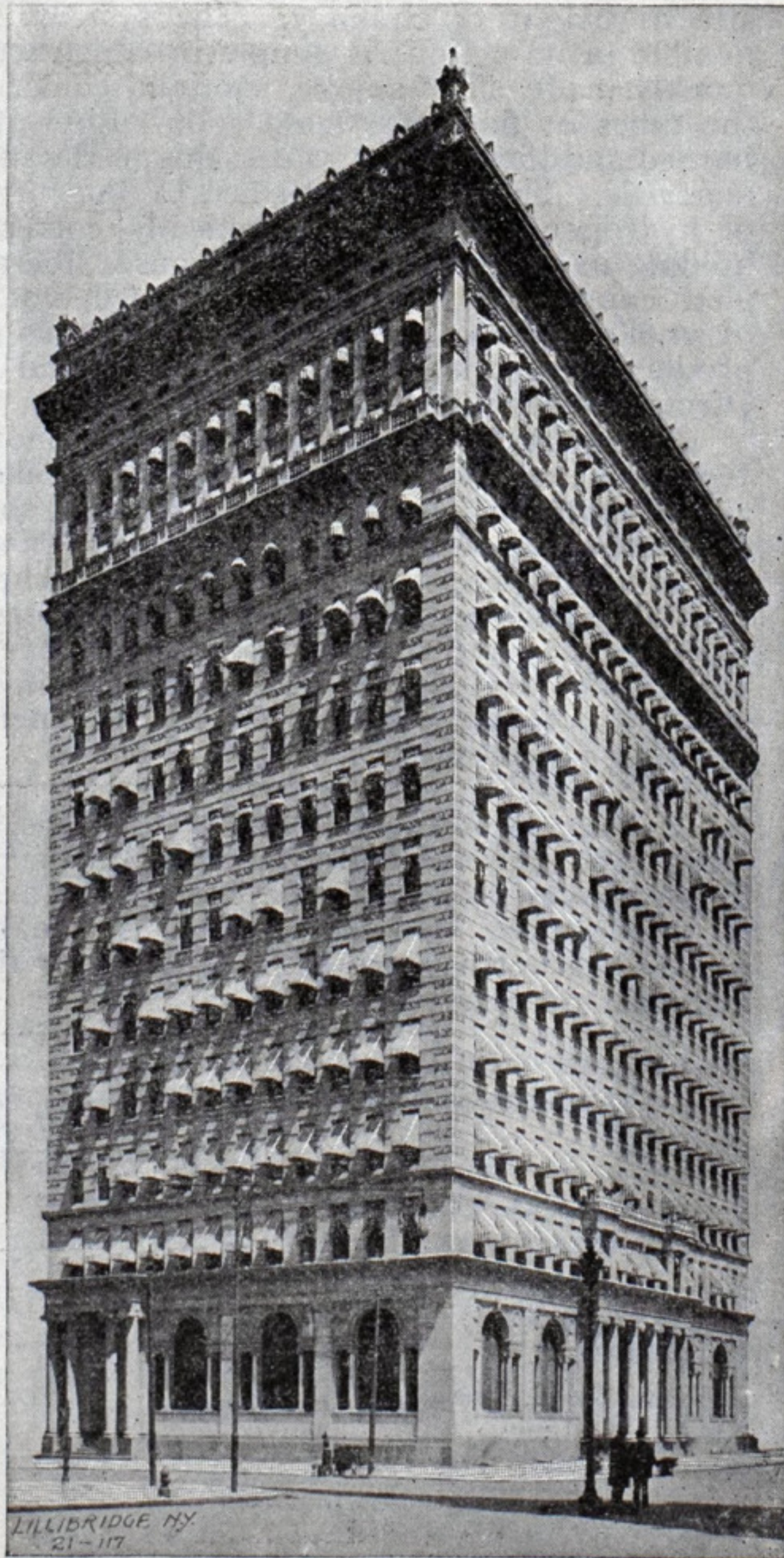


Fig. 2. Compressor Plant.

is 10 in. No change is required in either of the valves, cylinder heads or water jacket. This change can be quickly made and at a nominal cost. The valves are of tool steel and the valve seats can be removed and replaced by new ones at any time. Their construction will be understood from the section elevation, Fig. 2. Since the compressor is held firmly to the engine by tie rods, no foundation is necessary except enough to carry the weight of the compressor. The air cylinders are thoroughly cooled by water circulating through the jacket.



LILLIBRIDGE, N. Y., 21-185

**United Gas Improvement Co. Building,
Broad and Arch Sts., Philadelphia, Pa.**

STRUCTURAL STEEL SUPPLIED BY THE AMERICAN
BRIDGE COMPANY, PENCOYD PLANT.

Buildings, Bridges, Roofs, Trusses.

Steel Frame Work for
Mills, Factories, Race
Stands, Public Markets,
Power Houses, Car Sheds,
Etc., Etc.

**American Bridge
Company**

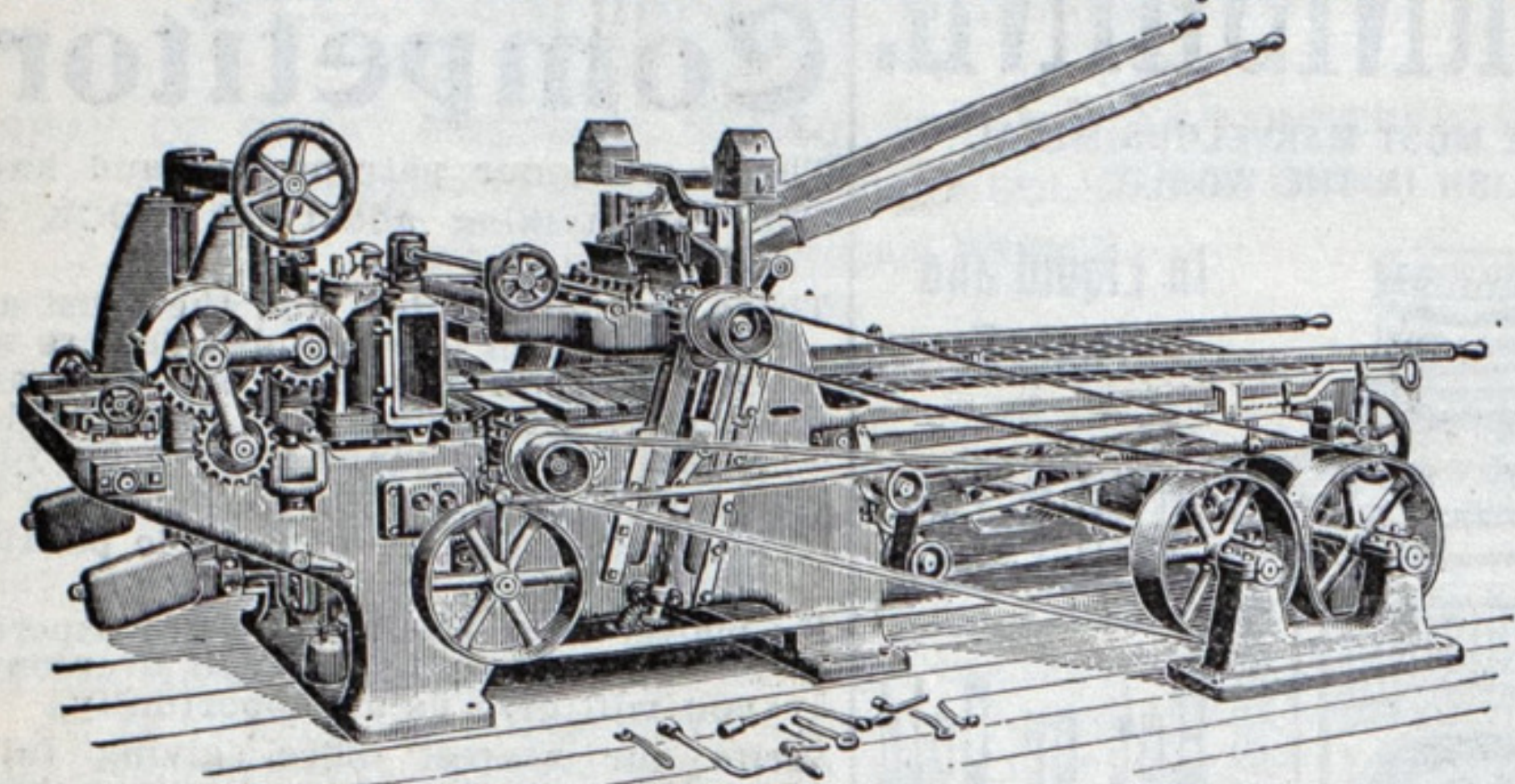
General Offices, 100 Broadway, N. Y.

Branch Offices throughout the country
European Office: LONDON

NEW DIMENSION PLANER AND JOINER.

The Review takes pleasure in illustrating a new machine—30-in. double-cylinder, endless bed "dimensioning planing" and jointing machine—made by the J. A. Fay & Egan Co., 325 to 345 West Front street, Cincinnati, O.

This machine is especially adapted for heavy surfacing, on one or both sides as needs be. It works stock on two sides 30 in. wide and 14 in. thick; will plane all four faces of a timber up to 28 in. wide and 14 in. thick; will plane at one operation two sides and one edge of two pieces of material up to 12 in. wide and 14 in. thick. The cylinders are forged



from solid crucible steel of very best quality. The side cutting heads are slotted and carry four knives. The feeding mechanism consists of a traveling bed, supported on four steel-faced ways, over which are placed two divided rollers, under which two boards of unequal thickness may be placed and fed at the same time. The feeds usually furnished are 40 to 60 in. per minute. For further information and description of machine in detail address the manufacturers, who will be pleased to have you correspond with them.

It is reported from Detroit that the American Blower Co. of that city is arranging for the erection of an extensive addition to its present plant. The plans are now being drawn, and it is expected to build in the early spring. The plans contemplate a large addition to the steel plate fan erecting shop, which will be a steel structure equipped with machinery of the latest designs. A new blacksmith shop will also be erected, and the plans also provide for a new power house and a large storage warehouse. As soon as the plans are completed the work will be pushed vigorously.

The Pan-American exposition at Buffalo opens May 1, 1901, and don't forget that the Nickel Plate road is the shortest and most expedient route to Buffalo and will land you directly at the exposition gates. Rates are in effect April 30, 1901, and good going or returning on any of our trio of daily express trains. Write, wire, 'phone, or call on nearest agent, C. A. Asterlin, T. P. A., Ft. Wayne, Ind., or E. A. Akers, C. P. & T. A., Cleveland, O.

No. 37 June 1.

In another part of this issue the Williams & Rodgers Co. of Cleveland, Superior and Seneca streets, announce that they make a specialty of fitting out vessels in such lines as carpets, rugs, furniture, curtains, bedding, etc. In view of the approach of another season of navigation on the great lakes, they ask for the opportunity of submitting prices for complete outfits of this kind. This company has been looking after marine trade in this line for a great number of years past.

One of the largest houses outside of New York handling carpets, curtains and upholstery goods of all kinds is Sterling, Welch & Co. of Cleveland. They are importers, wholesale and retail dealers. They make a specialty of marine trade and have enjoyed a large patronage in that line for many years past. With the opening of another season of navigation on the great lakes, they announce that they are prepared to meet at the lowest market prices the wants of ship owners.

Settlers' rates via the Nickel Plate road—Beginning with Tuesday, Feb. 12, low rate settlers' tickets will be on sale every Tuesday to and including April 30, to Oregon, Montana, Washington and all points in the Northwest. Write, wire, 'phone or call on the nearest agent, C. A. Asterlin, T. P. A., Ft. Wayne, Ind., or E. A. Akers, C. P. & T. A., Cleveland, O.

10 April 30.

"Seaboard Steel Castings."

MANUFACTURERS OF

"THE ADMIRAL" ANCHOR.THE LATEST AND BEST
STOCKLESS ANCHOR.

APPROVED BY LLOYD'S.

ANCHORS CAST AND TESTED ON
ORDER, OR STOCK ORDERS
PROMPTLY FILLED.**A GUARANTEE OF QUALITY.**OPEN-HEARTH STEEL CASTINGS
OF THE HIGHEST GRADE.
FACILITIES FOR CASTINGS UP TO
80 000 POUNDS WEIGHT.MACHINE WORK AND PATTERNS
FURNISHED WHEN REQUIRED.

RAIL OR WATER DELIVERIES.

CAPACITY, 500 TONS PER MONTH

Seaboard Steel Casting Co.,

CHESTER, PA.

"BENEDICT-NICKEL" SEAMLESS TUBING

FOR CONDENSER TUBES

Contains NO ZINC
nor any weaken-
ing metal.

Send for Booklet with
treatise on "Electrolysis
of Condenser Tubes."

Benedict & Burnham Mfg. Co., Mills and Offices, Waterbury Conn.
New York, 253 Bd'wy.
Boston, 172 High St.
Chicago, Cor. Lake & Clark Sts.

BELLEVILLE GENERATORS

Grand Prix 1889

Originated 1849

Hors Concours 1900

Latest Improvements 1896

Number of Marine Leagues made each year by Steamships of the Messageries Maritimes Co., Provided with Belleville Generators—Since their Adoption in the Service.

Year.	Australian	Polynesian	Armand Behic	Ville de la Ciotat	Ernest Simons	Chili	Cordillere	Laos	Indus	Tonkin	Annam
1890.....	22,576	820									
1891.....	22,749	22,777	68								
1892.....	22,749	22,801	23,274	7,753							
1893.....	22,793	22,781	22,762	22,749							
1894.....	22,813	22,789	22,858	22,813	12,567						
1895.....	22,891	22,922	22,913	22,936	13,629	9,571					
1896.....	23,178	30,906	23,232	23,183	20,735	21,051	13,572				
1897.....	22,750	23,202	30,912	23,185	20,745	25,370	21,119	14,382			
1898.....	23,646	23,178	23,184	23,199	20,842	21,080	21,080	20,851	21,318	7,569	
1899.....	23,178	23,205	22,477	30,135	20,082	20,926	20,956	17,448	18,285	14,669	7,628
Total.....	229,323	215,381	191,680	175,953	108,600	97,998	76,727	52,681	39,603	22,238	7,628

ATELIERS ET CHANTIERS DE L'ERMITAGE, À ST. DENIS (SEINE), FRANCE.

WORKS AND YARDS OF L'ERMITAGE ST. DENIS (SEINE), FRANCE.

TELEGRAPHIC ADDRESS: BELLEVILLE, SAINT DENIS, SUR SEINE.

DAMP RESISTING PAINT AND CEMENT

Toch Bros. of 468-472 West Broadway, New York, paint makers, established in 1848, have been building up a very large trade of late among ship owners, ferry companies and railroads for what they call R. I. W. damp resisting paint. It is waterproof and is used in all manner of places (made as a marine cement also) aboard ship. The initials R. I. W. stand for "remember it's waterproof." It is recommended for all ship framing and plating, even if some other paint is used afterward. Among claims made for it are these: Adapted particularly to treatment of ships' bilges before cementing, as it makes an absolute waterproof coating, while also forming a binder between ordinary cements and the steel or iron plating, uniting them in a homogeneous mass; made also in the form of a plastic cement, which may be put to any use that the ordinary or Portland cements are put, with comparison as to cost and long tenure of life in its favor; the cement used also in ship glazing for dead lights, deck lights, gratings, etc., for which purposes it is said to be more flexible and longer-lived than the best white lead putties; suited to making all permanent joints in condensers, salt water pipes, sea connections on ship sides, etc.; also to engine beds, pump foundations, boilers and their foundations, etc., before setting these parts.

As regards present methods of caulking a paragraph in one of the circulars pertaining to this cement says: "It does away with the ordinary laborious methods of caulking with cotton, oakum and pitch. It can be applied in half the time, and by the ordinary labor. It provides an elastic bond between deck planks, which never cracks nor deteriorates, and is absolutely impervious to water at all times; giving with the working of the ship, but remaining intact. In this line the cement is conceded to be of such great value that it will not be long before it will entirely supplant the old, expensive method of caulking."

Sealed proposals will be received at the office of the Light-House Board, Washington, D. C., until 2 o'clock, P. M., April 24, 1901, and then opened, for furnishing the materials and labor of all kinds necessary for the construction and delivery of the stern-wheel steel steam tender Oleander, in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to the Light-House Board, or at the office of the Light-House Inspector, Memphis, Tenn. F. J. Higginson, Rear Admiral, U. S. N. Mar. 28.

U. S. Engineer Office, Customhouse, Cincinnati, O., March 22, 1901. Sealed proposals for hire of Towboat having cylinders about 14 inches diameter, with 5 feet stroke, to serve as tender for Ohio River Dredges during present season, will be received here until 2 p. m., April 26, 1901, and then publicly opened. Information furnished on application. Wm. H. Bixby, Maj., Engrs. Apr 18.

BURNISHINE.

THE MOST MARVELOUS METAL POLISH IN THE WORLD.



In Liquid and Paste Form.

Will Polish

Hot or Cold

Metal,

no matter which.

Produces a wonderfully brilliant lustre on brass, copper, nickel and all metals, no labor required.

Used on steamers all over the world. Free samples on application.

J. C. PAUL & CO.

57 Dearborn St., CHICAGO, ILL.

Ahead of all Competitors.

That's what our patrons say and know. They are talking about GARLOCK PACKINGS.

There are none better, and the "just as good kind," which unprincipled dealers will try and palm off on you, is indifferent and inferior stuff, the use of which will surely disappoint and make trouble for you.

We will co-operate with you in every way in the successful use of reliable packings on your plant.

No matter what trouble you are experiencing in this connection we will overcome it if you will give us an opportunity.

Write our nearest office, giving full particulars as to your requirements, and your wants will receive attention by return mail.

Send for catalogue and samples to our nearest office.

THE GARLOCK PACKING CO.

NONE GENUINE

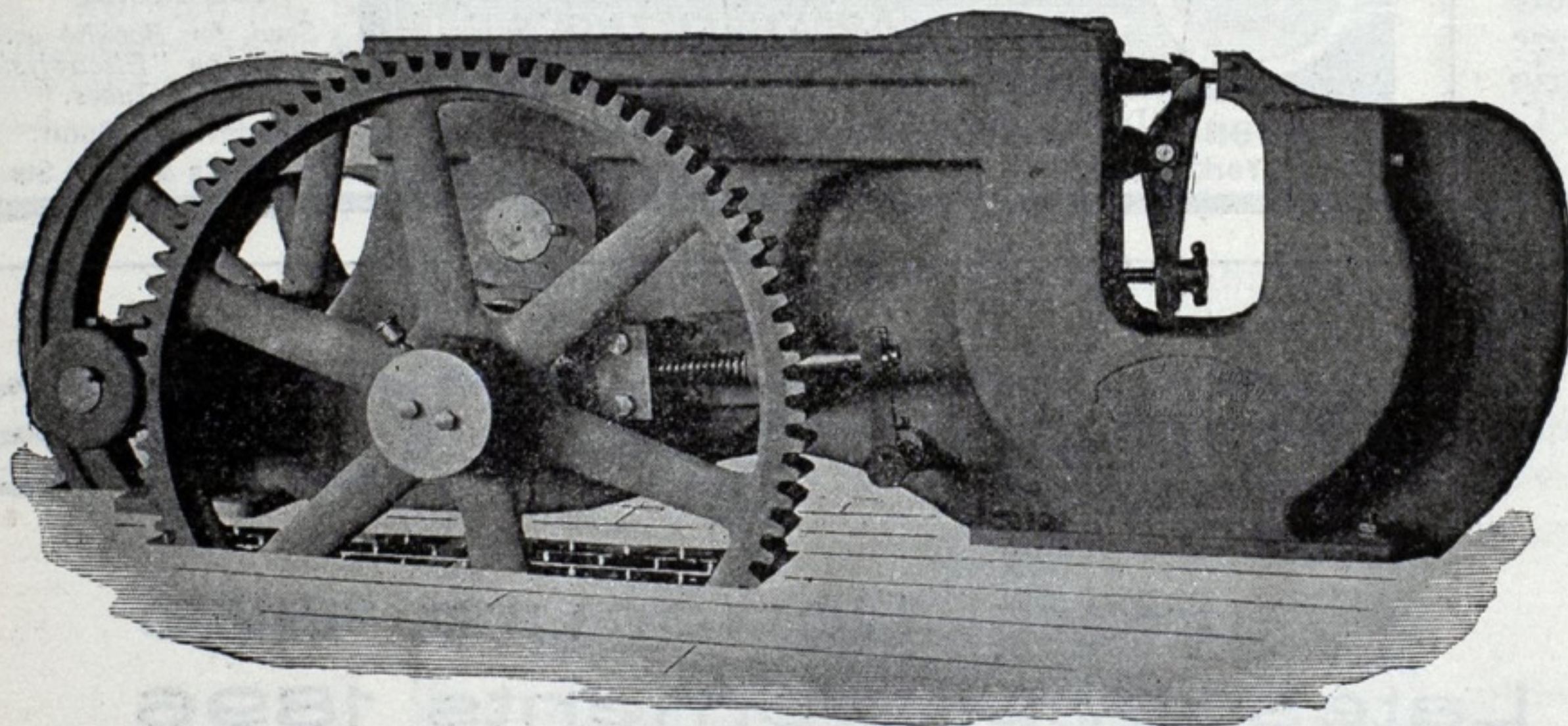


WITHOUT IT.

New York. Philadelphia. St. Louis. Boston. Pittsburgh. Denver. Chicago. Cleveland. San Francisco.

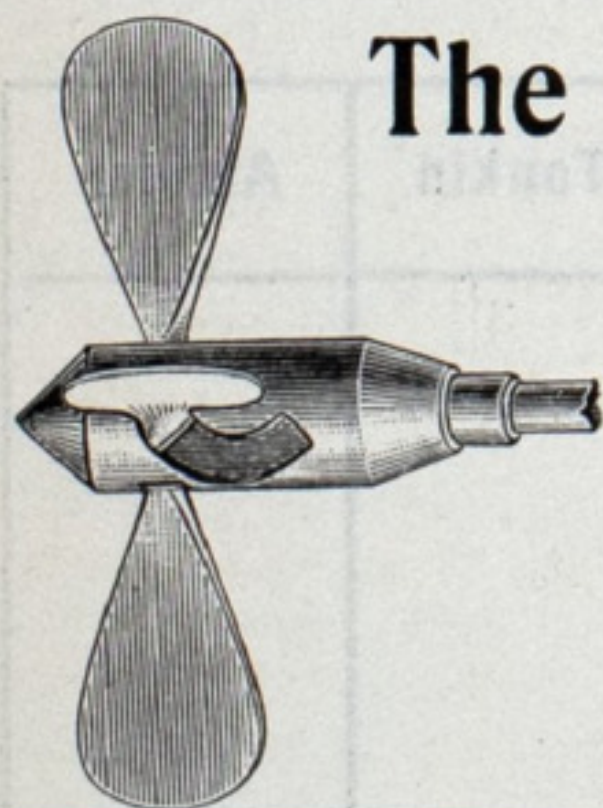
MAIN OFFICES AND FACTORIES: PALMYRA, N. Y.; ROME, GA.

THIS ILLUSTRATES OUR

HORIZONTAL PUNCH

which is a very useful tool in any shop, and is especially designed for punching angles, channels, beams, and flanges of boiler heads. This punch is equipped with our regular punching attachment and automatic stop, and is built in several sizes of throat from 6 in. to 40 in., with capacities from $\frac{3}{8}$ -in. hole through $\frac{5}{8}$ -in. plate to $1\frac{1}{4}$ -in. hole through 1-in. plate. We can satisfy you that we have the best horizontal punch on the market, and will be pleased to correspond with you if you are in need of such a machine.

The Cleveland Punch & Shear Works Co., CLEVELAND, O. U. S. A.

**The Crescent Feathering Reversible Propeller.**

Manufactured with 2, 3 and 4 Blades.

SUPERIOR GAS ENGINE WORKS.

WEST SUPERIOR, WIS.

Apr. 4.

SIDE-WHEEL TUG FOR SALE.

Length 66 ft., depth 5 ft. Boilers new. Machinery in good state of repair. For further particulars address The I. Stephenson Co., Wells, Delta County, Mich. tf

FOR SALE OR CHARTER.

First-class British steamers, of Welland canal dimensions; about 3,250 gross tons capacity, carrying about 2,000 gross tons on 14 ft. (fresh water) draught. Speed 10 knots loaded; easy consumption. Large hatchways. For further particulars address "Charter," The Marine Review Pub. Co., Perry-Payne Bldg., Cleveland, Ohio. tf

LARGE LAKE FREIGHTER.

For Sale—Large, first-class, steam freighter. For further particulars apply to or address J. K. Harrow, No. 225 Sixth street, Detroit, Mich. Mar. 28.

VESSEL HULL FOR SALE.

First-class, newly-constructed passenger and freight hull, 97 ft. over all, 89 ft. keel, 18 ft. beam. Hull has very fine lines. Suitable for great lakes. Draught, light, 3 ft. 10 in. aft and 2 ft. forward. Have high pressure engine, 14x14 in., but no boiler. Will sell reasonably cheap for cash. For particulars address F. W. Reynolds, Canajoharie, N. Y. April 4.

STEAM YACHT FOR SALE.

A small, nicely-equipped, private steam yacht in perfect order. Dimensions: Over all, 57 ft.; beam, 8 ft.; draught, 4 ft. 2 in. Commodious forward and after deck with large pilot-house and comfortable trunk cabin. Having purchased a larger yacht, will sell this at a great sacrifice. Full particulars will be given by addressing O. P. Letchworth, Buffalo, New York. Mar. 28.

TUG FOR SALE AT A BARGAIN.

Fishing tug Fred King. One of the best on Lake Erie. Robison Basket Co., Painesville, O. [March 28.

FREIGHT AND PASSENGER STEAMER

A. B. Taylor is for sale. Vessel 106 ft. keel, 22 ft. beam. Freight capacity, 115 tons; passengers, 200. Electric light; good sea boat; speed, 11 miles; economical. E. C. Dunbar, Grand Haven, Mich. April 4

Five Electric Passenger Launches For Sale.

In fine condition. Length over all, 35 feet. Seating capacity, 28. Send for price list. Yacht brokers, please note. Milwaukee Electric Launch Co., 1504 Monadnock Block, Chicago. tf